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FISHERY INVESTIGATIONS

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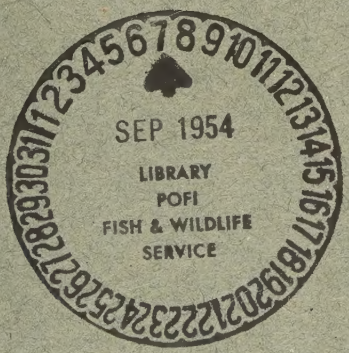
Report on Research from the *Ernest Holt* into the Fishery near Bear Island 1949 and 1950



LONDON: HER MAJESTY'S STATIONERY OFFICE

1954

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MINISTRY OF AGRICULTURE AND FISHERIES

FISHERY INVESTIGATIONS
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REPORT ON RESEARCH FROM THE *ERNEST HOLT* INTO THE FISHERY NEAR BEAR ISLAND 1949 and 1950

By

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Naturalists on the Staff of the Ministry of Agriculture and Fisheries

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PREFACE

THIS is the first report on English fishery research in the Arctic since the reconstruction of the scientific staff after the 1939–45 war. Arctic fishery research carried on at all seasons of the year is a new venture and was approached carefully by stages, as described in the early part of this report. The research continues at the time of writing.

This paper appears under the names of members of the Arctic team of the Fisheries Laboratory at Lowestoft, who have written it jointly. It is intended that other papers, one of which has already been written by Lee (1952), should be the work of one or more of the members of the team. Such papers will be on particular subjects, whereas the present paper is intended to provide a general account and a frame of reference containing those details of the ship, of voyages, and of stations, which might otherwise have to be repeated in several future papers. For greater usefulness, some of the Appendices are brought up to a later date than the body of the report, which refers only to 1949 and 1950.

Because the research was developed so as to attack one main problem above all others, this paper is in part a progress report on studies of the use of the thermometer as an aid to fishing on the Bear Island Bank. The paper by Lee, referred to above, uses the same material for a study of the relation between hydrography and the cod fishery; in the present report the material will be treated as a narrative, unfolding successively the possibilities in practical application.

The help of the Senior Officer, Fifth Fishery Protection and Minesweeping Squadron, and of members of the Fishing Industry who have carried naturalists on commercial voyages, is gratefully acknowledged, as also is all the friendly advice and assistance so freely given at the start of this new venture.

Ministry of Agriculture and Fisheries

May, 1954

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INTRODUCTION

HE earliest records of fishing at Bear Island are of Norwegian trappers who wintered on the island 1825 and again in 1865, and who caught cod on handlines. Later, between 1873 and 1883, a nall fleet of Norwegian vessels fished for cod off the west and north-west coasts of Spitsbergen. atches were good until 1883, but in that year only three fish were caught by 18 vessels. From then ntil 1924 no commercial fishing vessels visited the grounds, but the Germans and Norwegians ccasionally sent a research ship to fish the area. The Germans made two experimental cruises in 98 and 1899, without catching any fish. The Norwegian voyages were made in 1901, 1905, 1906 nd 1914. Catches were again poor, except for a good catch of halibut in the summer of 1914. he Norwegians resumed their research in the Bear Island area in 1924. Good catches of cod were otained in June 1925, and a few Norwegian line fishermen and other foreign commercial fishing oats made successful trips there. In 1928 English trawlers first visited the area, and since 29 they have fished there regularly except during the war years. The Bear Island area, which is own with other distant-water fishing grounds in Fig. 1, quickly became, and has continued to be, e largest single source of fish to Great Britain. There have been, nevertheless, both seasonal and ng-term fluctuations in the catches, the latter possibly being associated with the long alternating eriods of cooling and warming of the Arctic regions (Lee, 1949).

Before the 1939–45 war, the Fisheries Laboratory did not possess a vessel suitable for carrying ut Arctic research. The naturalists of the laboratory did, however, make occasional voyages commercial trawlers in order to measure and mark fish and to note feeding and stages of aturity. The first of these voyages was made in July 1930 by J. Armitage Robertson, who was nt by F. M. Davis to measure the length distribution of the cod taken near Bear Island. At the me time he collected samples of plankton, of benthos, and of the stomach contents of the sh, and made some hydrographic observations. Robertson's observations, with Lundbeck's, haracterized the stock as of small and medium-sized fish, the larger of them maturing or perhaps ature (Robertson, 1932; Sund, 1932).

Davis made three trips to mark fish in the area: one in October 1937, another in October 1938, nd the last in May 1939. Some of these marked fish were recaptured, and a summary of his results given in Appendix I.

During the same decade, Trout, as a student, and some members of the fishery research staff of e University College of Hull, went on commercial voyages, and arranged for the collection of omach contents at all seasons of the year. The results of this work were reported by Brown and heng (1946), and they showed the importance of Euphausids* (" pink shrimp "), Amphipods large-eyed shrimp "), capelin, and herring, as food of these immature and rapidly growing cod. he nature of the food organisms indicated that the cod in the Bear Island region does not ways stay near the sea bottom, but spends part of its time feeding in mid-water.

THE SHIP AND THE PROGRAMME OF RESEARCH

During the 1939–45 war a Committee on Post-War Fisheries Research, under the Chairmanship Professor J. Graham Kerr, was set up as part of the advisory organization of the Development ommission, with a sub-committee for marine research, under the Chairmanship of Dr. E. S. ussell. Among the proposals submitted by the Ministry of Agriculture and Fisheries to the sub-mmittee was one that a research vessel should be provided for use on the fishing grounds of the rctic. This proposal was favourably received. It was suggested later that a ship be designed ecifically for working in the Spitsbergen-Barents Sea area, which is rather remote from other rctic fishing grounds. The Committee's report was approved by the Ministry early in 1946, nen plans for building such a vessel were put into action. She became the ERNEST HOLT.

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* Otherwise, and perhaps better, called Euphausiids.

LABRADOR
GREENLAND
NEWFOUNDLAND
ICELAND
BEAR ISLAND
NOVAYA ZEMLYA
NORWAY
70°W
60°N
50°
40°N
80°N
75°
70°
65°
55°N
60°
50
40
30
KEY
FISHING GROUNDS
MEAN LIMIT OF WINTER ICE

Three problems were principally in mind when plans were being considered for the building, aintenance, and staffing of a research vessel for use in the north-east Arctic. Davis had confirmed at the immature fish of the Bear Island area were part of the same stock as the mature fish caught the Norwegian fishery centred on the Lofoten Islands; this raised the possibility of the new hery having an adverse effect on the stock, including the fishery at Norway. Secondly, the uestion arose whether there are any factors that might be used as an aid to more effective fishing. s elsewhere in fishery research, these questions come under the heading, " the best use of fish ocks." The third problem was concerned with the effects on the fishery of climatic fluctuations in e Arctic regions.

In 1945, Trout, Graham, and Beverton, were able to make voyages in commercial trawlers. he object of Trout's voyage in the S.T. LOCH OSKAIG from October 18 to November 11, was to make bservations immediately after the wartime respite from fishing. He found an abundance of large sh (75–90 cm.) forming half the catch. This might well have indicated increased survival due to e wartime respite; but Rollefsen (1948) has shown that this may have been due at least in part to e presence of one exceptionally large year class. The objects of the voyage in S.T. NORTHERN GIFT ndertaken by Graham and Beverton from November 16 to December 13, were two: the choice a starting point for the programme of the proposed research vessel, and the formulation of quirements in building her: in other words, what she should do, and as a consequence, what she ould be. The fish were abundant SSE of Bear Island in 115 fathoms, and were not feeding. onversations with skippers, and previous knowledge, made it clear that nobody knew why these d concentrate in the area, still less why high catches are localized on particular parts of the bank, hich change from voyage to voyage. Bearing in mind the temperature relationships claimed in the ewfoundland area (Thompson, 1933 and 1943) and the variety of waters in the Greenland and rents seas, the first problem to tackle seemed to be that of the relation between fish and tempera- re. This would require fishing of a standard equal to that of commercial trawlers, whose informa- on on catches would be integrated with that obtained by the research vessel, which would therefore ve to be a good Arctic-type trawler. The key members of the crew of the NORTHERN GIFT agreed at the trawler MAN O' WAR surpassed all others of her day in proved sea quality, from which formation came the recommendation on which the ERNEST HOLT was built. It was especially ted that commodious laboratories at deck level would have to be sacrificed in order to avoid due top-hamper and the restriction of deck space.

During 1946, the vessel was designed by Mr. V. Gray of Selby with Mr. C. W. Wilson of Glasgow ting for the Ministry. As S.T. ST. BARTHOLOMEW (NOW STELLA ARCTURUS) was, in their opinion, improvement on the MAN O' WAR, and had behaved well in bad weather on her maiden com- ercial voyage, the new ship was built to her lines. This was a decision which has not been re- etted, and it may be recorded at this point that the ERNEST HOLT has turned out to be a very good -ship.

The new ship was launched at Selby on June 9, 1948, by Mrs. A. T. A. Dobson, wife of the sheries Secretary who had been in office during the planning period. The launching is well strated by Trout's photograph (see Plate II), the broadside launch being necessary in the restricted ters of the Yorkshire Ouse. In naming her ERNEST HOLT it was thought fitting to commemorate pioneer naturalist in North Sea fisheries investigations, whose work at Grimsby in the 1890s d provided the foundation for this branch of science (Holt, 1893, etc.).

Except for her distinctive paintwork, the ERNEST HOLT might be taken to be a commercial trawler. e chief difference was the extension of the amidships and bridge superstructure 3 ft. 6 in. forward, order to accommodate a small deck laboratory. Later on, in 1951, it was found advantageous add an hydrographic laboratory on the boat deck aft, because the amidships position proved th wet and awkward for hydrographic work (Appendix III). The ship appears as shown in the otograph (Plate I). She is 175 ft. long B.P., 30 ft. beam, and 16 ft. moulded depth, with a ximum draft of 17½ ft. Burning oil fuel in a Scotch-type boiler, her triple expansion engine velops 900 B.H.P., giving her a normal steaming speed of 11 knots.

The general arrangement is shown in the diagrams (see Fig. 2). It has proved, in the main, irely satisfactory, with the exception that 210 tons bunker capacity is sometimes found to be ufficient. Some of the space allotted to the amidships saloon and its accompanying galley could, h suitable adjustments of other spaces, have accommodated a vertical oil tank filled to deck

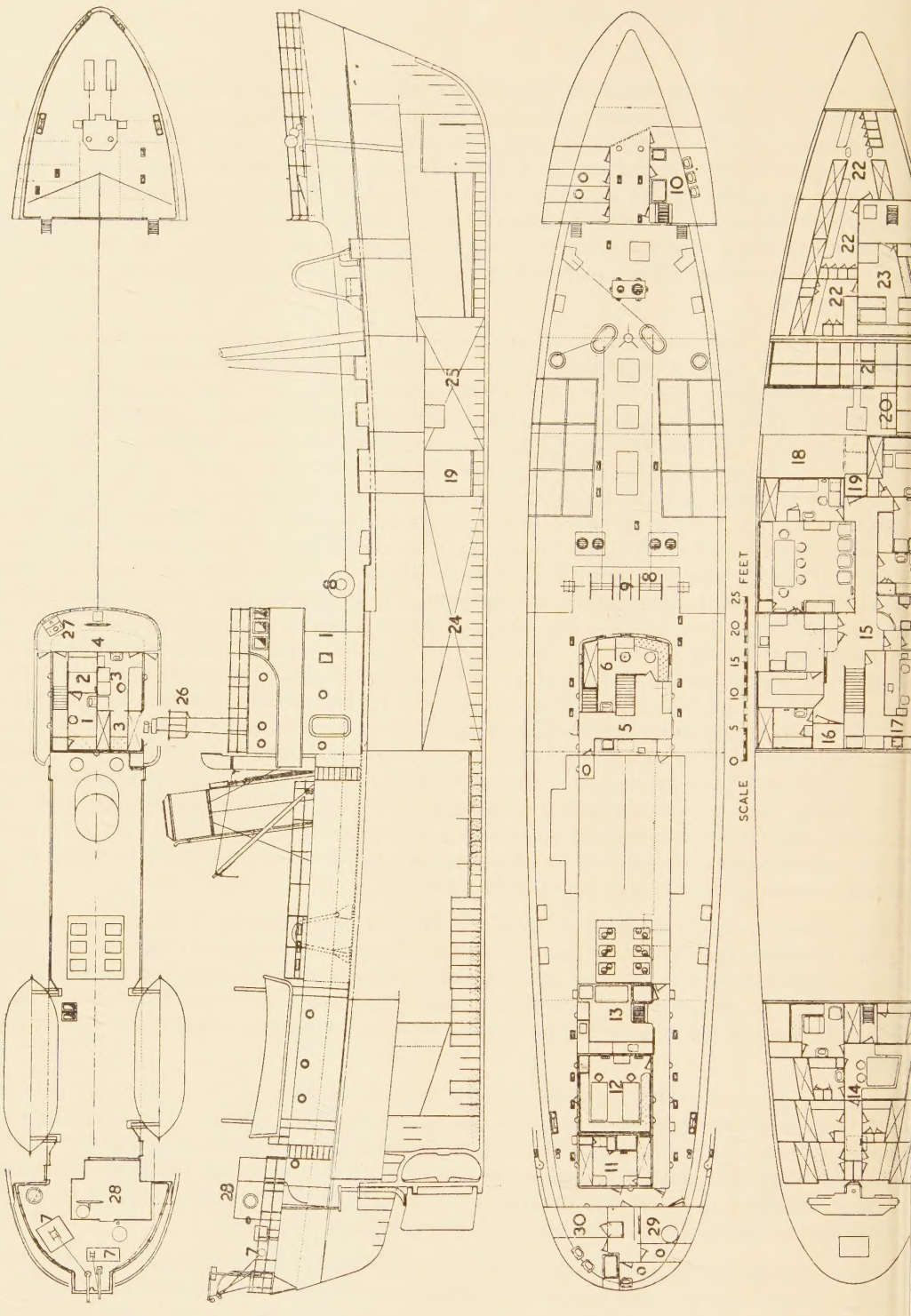


FIG. 2

General arrangement of the R.V. ERNEST HOLT.

1. Navigator's cabin.
2. Chartroom.
3. Wireless room and operator's cabin.
4. Wheelhouse.
5. Deck laboratory.
6. Master's cabin.
7. Hydrographic winches.
8. Trawl winch.
9. Extra barrels for Plankton work.
10. Crew's washroom.
11. Firemen's cabin.
12. Crew's messroom.
13. Galley.
14. Officers' accommodation.
15. Scientists' accommodation.
16. Master gyro compass.
17. Main laboratory.
18. Refrigeration machinery.
19. Scientific gear store.
20. Quick-freezer and low temperature store.
21. Fishroom.
22. Crew's cabins.
23. ,, recreation room.
24. Oil bunkers.
25. Water tanks.
26. Radar scanner.
27. ,, viewer.
28. Hydrographic laboratory.
29. Liver boiler room.
30. Refrigerator.

evel and feeding all other tanks by gravity. In 1951, the installation of radar apparatus, and a emand for sleeping quarters for two additional ship's officers, made sacrifices in other accommoda- on space necessary. As in all fishery research vessels, there is a need for the life-boats to be usable s small fishing boats. In the opinion of her first Master, Captain W. R. Ingham, a 3-tier bridge, o allow better view over the ship's bows, would have been a substantial advantage.

The question of which Humber port should be chosen as her base received considerable thought, owestoft harbour being too shallow. Grimsby was selected on account of proximity to the ntrance of the estuary, and its relative convenience of access by road from Lowestoft.

The ship's officers consisted at first of a fully certificated Master and the corresponding grade of ngineer, the remainder of the officers holding fishing certificates. It was found in practice that an ssistant Navigator and a Second Engineer, both with full Merchant Service certificates, were equired.

The resulting complement was as follows:

Master	Mate	Chief Steward
Navigator	3rd Hand	2 Cook Stewards
Chief Engineer	3rd Engineer	1 Assistant Cook
Second Engineer	4th ,,	3 Firemen
Fishing Skipper	Wireless Operator	9 Deckhands

The planned complement of research staff was two naturalists and two technicians; but it was ound necessary to modify this to three naturalists and one or two technicians.

Trials were carried out in the Humber in December 1948 and the ship sailed from Grimsby on er maiden voyage on January 4, 1949.

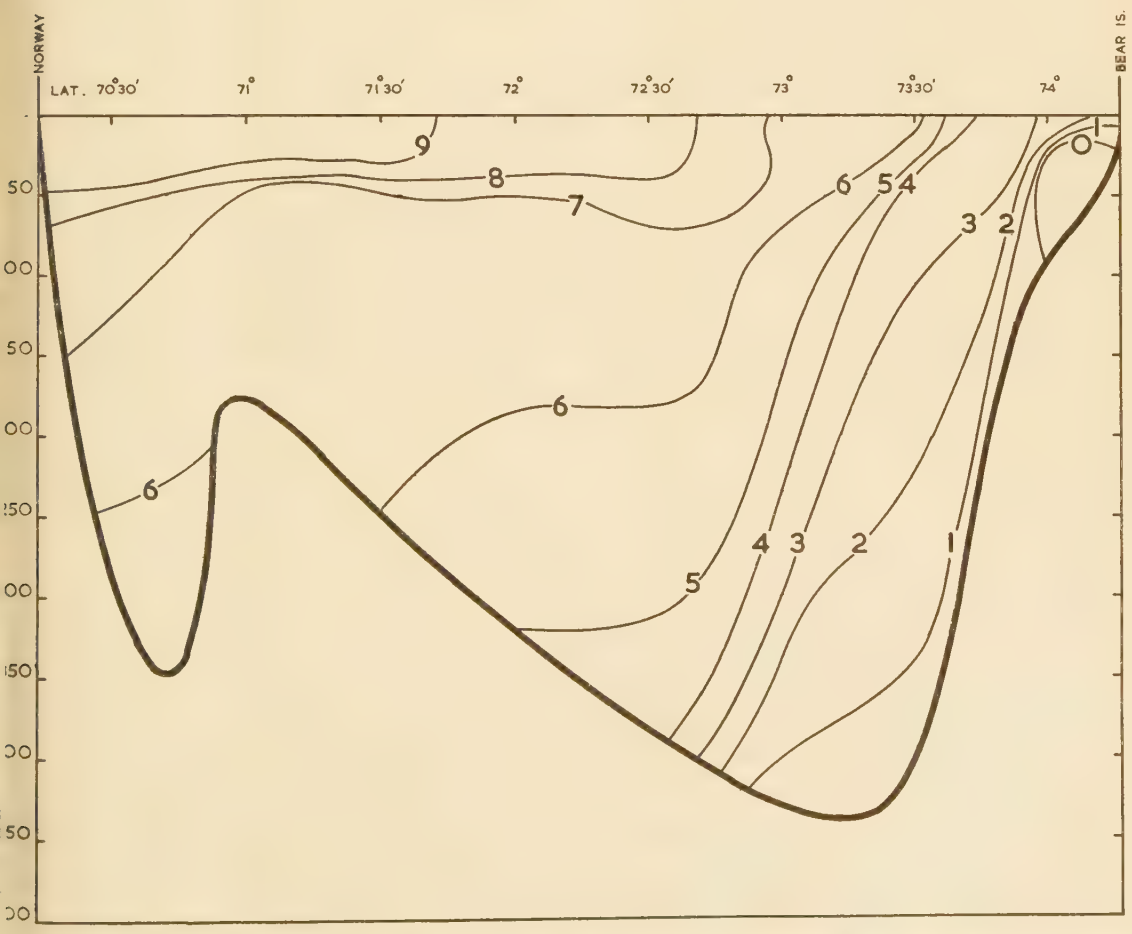
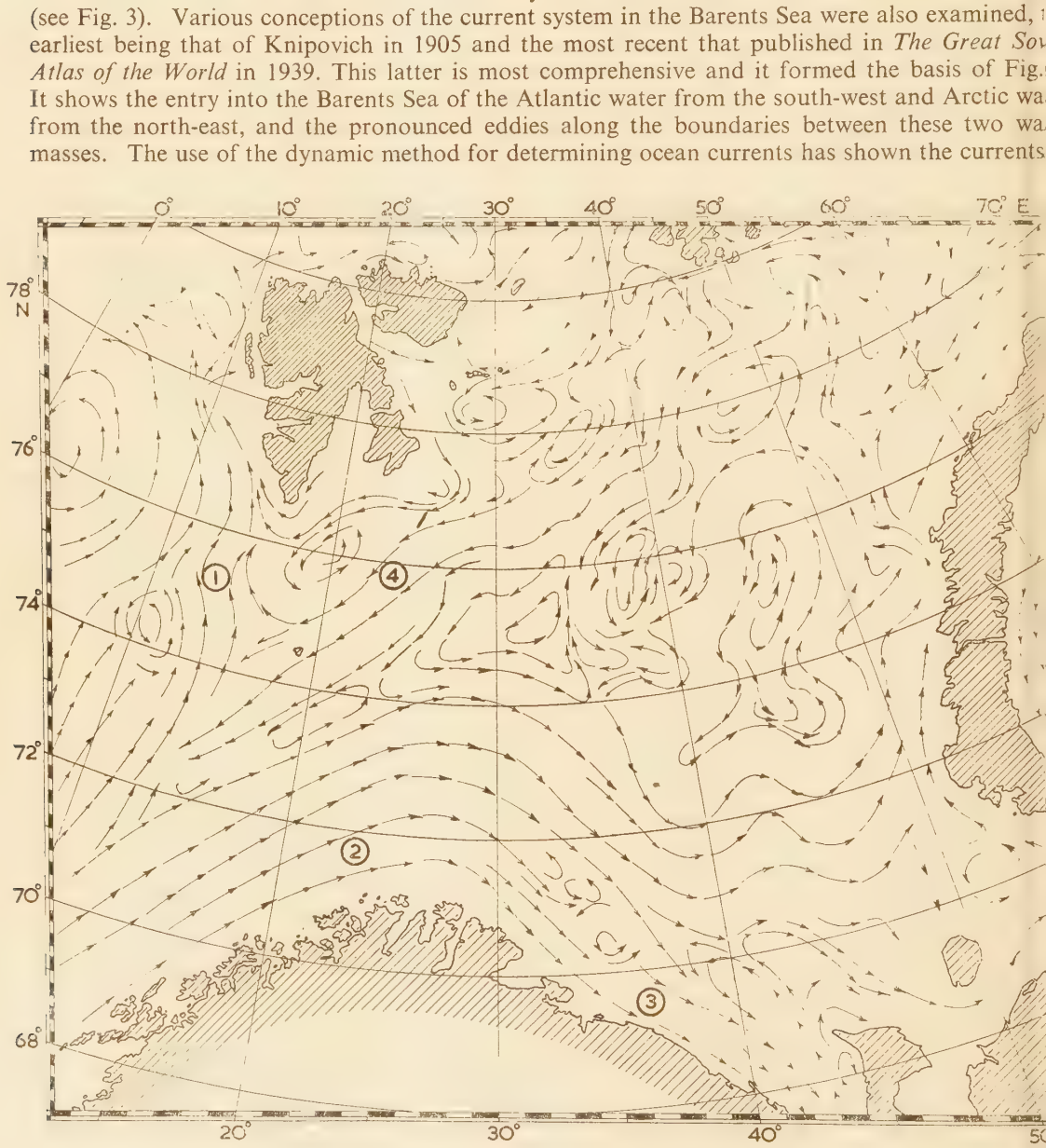


FIG. 3. Distribution of temperature (°C.) in September along the 19 deg. E meridian from Bear Island to Norway.

While the ship was being built, the Hydrographic Section of the Fisheries Laboratory un Lt.-Cdr. J. R. Lumby, R.N. (Retd.) was examining a vast amount of information about the hyd graphy of the Barents Sea. This information had been collected by Lt.-Cdr. Lumby while serv at the Admiralty during the 1939–45 war. It was fortunate that for this study Professor Gunn Granqvist, the Finnish hydrographer, was available for temporary employment during the summ of 1948. The Section, thus augmented, was able to provide a comprehensive survey of work up date, and to embody this in a paper by Lumby & Lee (1949) which was read to the Challen Society in July 1948. As this paper contained no new material, only an abstract has been publish but the main substance of the paper may provide an introduction to some future publication. proved, however, invaluable in discussions on the proposed programme. Lumby & Lee descrit the properties and distribution of the Atlantic and Arctic waters, the two main water masses in t Barents Sea. These meet in the Bear Island area and give rise to a marked front south and w of the island. A vertical section from Norway to Bear Island shows the structure of this fr (see Fig. 3). Various conceptions of the current system in the Barents Sea were also examined, earliest being that of Knipovich in 1905 and the most recent that published in *The Great So Atlas of the World* in 1939. This latter is most comprehensive and it formed the basis of Fig. It shows the entry into the Barents Sea of the Atlantic water from the south-west and Arctic wa from the north-east, and the pronounced eddies along the boundaries between these two wa masses. The use of the dynamic method for determining ocean currents has shown the currents



(1) West Spitsbergen current.
(2) North Cape current.
(3) Murman current.
(4) Bear Island current.

FIG. 4. The Barents Sea: surface currents.

e Barents Sea to be, on the whole, weak and variable. At about the same time Lee also prepared a mprehensive bibliography of the literature dealing with climatic fluctuations in the Arctic regions. iis forms the basis of a bibliography on the problem of climatic and ecological changes in rthern waters published by the International Council for the Exploration of the Sea (I.C.E.S., 49).

Although the scale and nature of the ERNEST HOLT had to be decided before she could be built, ere were many details of action and procedure to be settled before embarking on a new study, e methods of which might well be shaped for a considerable time by those used on the early uises. It was intended that practical details should be decided upon during the maiden voyage, which the members of the team would sail. But intermediate plans had to be made, necessiting a further survey of the commercial fishery. For this purpose, each member of the team iled on one voyage in 1948.

Trout, Graham, Beverton, and Corlett, in the steam-trawlers CAPE MARIATO, RINOVIA, LORD ENDER, and BORELLA respectively, made observations on the lengths, maturity, and feeding of the d on various Arctic fishing grounds. Special attention was paid to the rate at which the crew ndled the fish, because data on operational rates were required by the D.S.I.R. Station at Torry. addition, observations were made on the general organization of the ships, and on the use of the ips' time. The latter is illustrated by a diagram (see Fig. 5). Lee in H.M.S. CYGNET * made some gnificant hydrographic observations on water movements in the Bear Island region, as well as udying ice conditions and collecting information from trawlers speaking with the patrol vessel.

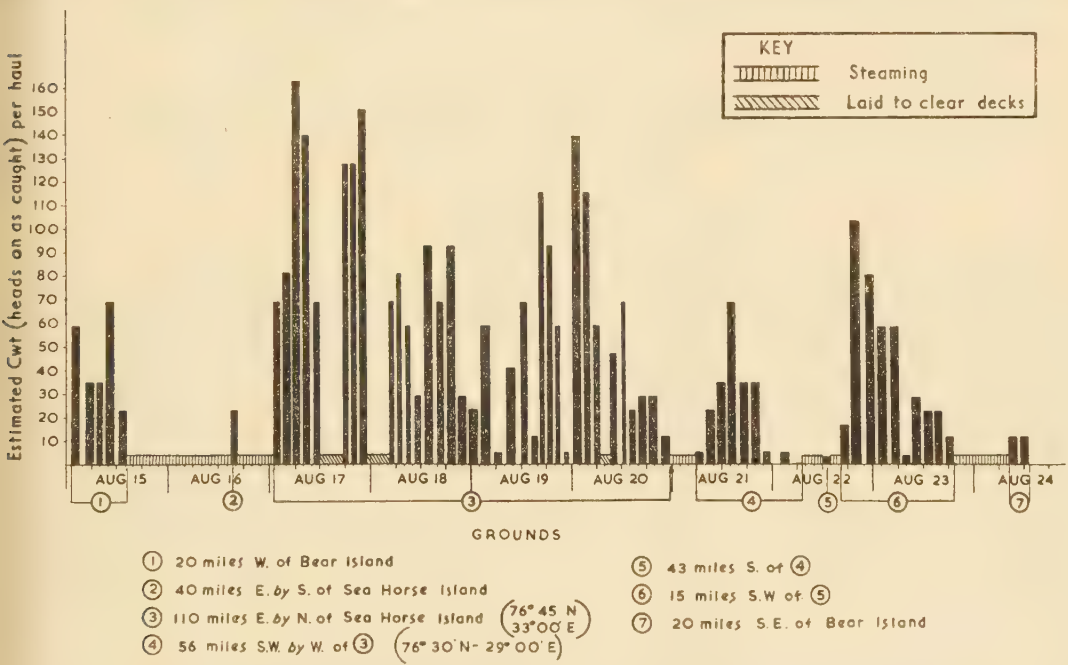


FIG. 5. Time chart of fishing operations of an arctic trawler in August 1948.

ptain Ingham sailed in the S.T. NORTHERN SUN in June to make observations on trawler practice wireless communication, navigation, crew organization, and fitting out. In addition, he also idied handling rates and the feeding of the fish. These cruises provided up-to-date information out the conditions and problems of the fishery. This knowledge was useful in planning the work the ERNEST HOLT, as it provided a background against which the importance and practicability research projects were judged in a series of meetings of the team towards the end of 1948.

ie Research Programme

At the first meeting on the programme, on October 29, 1948, questions which might form the sis of research were put by members from their experience of this fishery or of others. To the

* Lee read a paper on some results of this cruise to the International Council at Copenhagen in 1948. It is published, but will be included in some future work.

second meeting, on November 5, members brought such information as existed, bearing on questions, and came prepared to estimate the effort required to answer them.

An important question was: Is there a relation between (*a*) bottom temperature and fishing (*b*) hydrographic characteristics at all depths and fishing?

It is known that cod in the Newfoundland region are found in certain temperature ranges betw minus 0·5° C. and about plus 6° C., according to their age and the temperature to which they h become accustomed. The following information has been extracted from H. Thompson's rep (Thompson, 1943):

COD

Bottom Temperature

	Spring	*Summer and Autumn*
Newfoundland Banks	0° to 3° C. (large fish) 3° to 7° C. (small and medium)	3·5° to 5·5° C.
S.W. Coast of Newfoundland, Gulf of St. Lawrence, E side of Belle Isle Strait		Offshore (50f.) 0·5° to 6·5° (2° to 5° best fishing). Inshore 6° to 12° C. (8° to best).
S. Labrador, W side of Belle Isle Strait	—0·5 to 3° C.	2·5° to 8° C. (4° to 6·5° best)

HADDOCK

Between 4° and 7° C. with a maximum of 10°, with a " best temperature " range between 5° and 6° C.

GENERAL

The cod prefers colder water than does the haddock, although their ranges overlap.

It was considered that observations to test for correlation between fishery and bottom temp ture could be made among, and in the neighbourhood of, commercial trawlers on every cruise w the fishery is favourable for this investigation. Also, a grid of hydrographic stations could foll Each pattern of observations would take about four days, if the radius of the area of observa was 10 miles, and the trawlers concentrated about one position.

As a result of these discussions, the Director of Fishery Research was able on December 1 day or two before the ship's final trials, to submit to the Fisheries Secretary and to the Advis Committee of the Development Commissioners a programme for their approval. Omitting sailing schedule and allocation of naturalists, the programme is given below. In spite of all precautions taken, the aims proved too ambitious in some respects, but these were not of m importance. The aims on which there was no substantial progress in 1949 are placed here wi square brackets.

Aims

(i) [*To find the possibilities of echo-sounding as early as possible, confirming by hand-lining underwater photography.*]

(i)a [*To find if cod move in a definable type of water.* On favourable occasions hydrograp observations at standard depths would be made after a successful echo-search.]

(ii) *To begin investigation of the relationship between trawled fish and temperature.* Each ticular study will be based on a gathering of trawlers fishing for cod, [haddock or plaice, whiche species is at the time important in the catches] and wherever the trawlers may be. The gen method recommended is to trawl into* the significant area, making observations of bottom t perature between each haul, penetrating to the centre of the fishing, and to trawl out of it again

* It was found better to start within the area.

far side making the same observations. Supplementary observations could be obtained by ing bottom temperatures alongside working trawlers. [At the beginning, the middle, and the end each such scheme, a hydrographic station for temperature and salinity would be made]. The gth distribution of a sample of 200 fish from such hauls should be recorded. In addition, the ge of maturity and feeding percentage of 50 of these fish should be noted, and their otoliths noved for determination of age and origin. Any echo-traces observed during hauls should be served.

(ii)a *In suitable months (May to September), to investigate relationship between fish food and the hery.* This requires collections of stomachs (10 per haul) and of coarse-net hauls within and hout the concentration of trawlers.

(iii) *To begin a collection of hydrographic data as an index of any trend over a series of years.* o standard sections are to be established: along 19 deg. E* to Bear Island, and W (true) from ar Island.

(iii)a *To be on the look-out for plankton indicators and areas of high production during the working the sections.* For this purpose, Hensen nets will be worked from 50–0 metres.

(iii)b To make preliminary observations on the existence and seasonal occurrence of the nutrient aracteristics of different types of water: phosphate, oxygen, and pH.

(iv) *To carry out certain trials on the preservation of fish.*

(v) [*To determine the survival rate of cod in the fishery. (To be done on the fishmarket not in the* NEST HOLT.)]

(vi) *To encourage improvement in the chart, especially in blank areas.*

The aims are stated above in what was deemed at the time to be their order of priority. The oblems in practice turned out to be more complicated and more interesting than the programme licated, but the statement of aims provided a useful framework for the research described in the xt part of this report.

THE CRUISES—1949

Cruise I (January 4–26). The ship's maiden voyage was a trial of crew, equipment, and proce-re. It was on the whole successful, but there were numerous errors in procedure and minor ures of gear, many of the latter probably being inherent in new ships and apparatus. Some ing and hydrography were carried out successfully, but a misunderstanding and a defect in the r led to a serious loss of water-bottles. Under Arctic conditions it is essential that apparatus ould be of the simplest design that will fulfil requirements, otherwise the combination of cold, igue and darkness may lead to unnecessary losses of gear and time.

One of the main purposes of the cruise was the drafting of standing instructions. The scientific r and the standing instructions in use on the ERNEST HOLT at the end of 1951 are given in pendices II and VI.

It was confirmed that Tromsoe would serve for refuelling and other business of the ship, and agent was selected .The most useful duration of a cruise was considered to be from three weeks one month. During subsequent cruises this question was often reviewed and at the end of 1950 as decided to work on a basis of seven cruises per annum, of lengths adjusted to the tasks, but raging 28½ days. It was found advantageous to call at Aberdeen on the way out and back, ping up with fuel on the way north, with the possibility of doing so, in emergency, on the way th. Owing to the pattern of tides and berthing arrangements in Grimsby, fish caught by the EST HOLT was usually sold in Aberdeen.

Cruise II (February 7–March 3) was dogged by bad weather, after a delay caused by a failure in hydraulic steering gear—a failure that was not repeated. The principal aim was to use the echo-nder to survey shoals of cod. During the passage northwards, fish traces were recorded by the o-sounder at 90 fathoms depth, the depth of the bottom being 140 fathoms. These traces were erved in an area which was being worked by Norwegian line vessels, but no further traces were

* Amended, for navigational reasons, to " From Loppen to Bear Island ".

recorded during the cruise, although depths ranging from 80 to 230 fathoms were examined a grounds being worked by 18–20 trawlers were visited.

Cruise III (March 14–April 1). This cruise was notable for the success achieved in carrying both hydrographic and plankton work on a set programme, in spite of bad weather and a curt ment of the cruise owing to lack of fuel in Tromsoe. After trying several devices, it was fou impossible to manœuvre the ship to keep the hydrographic wire vertical, at least in the degree weather considered workable in other respects.

On Cruise IV (April 20–May 14), the first results were obtained relating fishing and temperatu and they immediately disposed of the simplest hypothesis that there would always be a clear relati ship available for fishermen's use. Whereas it was confirmed that a temperature range of 2°–4° was favourable, it was also shown that there was plenty of ground covered by water of that te perature in which catches did not reach paying level. Bottom temperatures on a line of stati through a trawler concentration, south-west of the Bear Island in about 210 fathoms, rose fr 1·5° C. to a peak of 2·8° C. among the trawlers and fell away again to about 1° C. at the end of line. Catches of cod correspondingly rose and fell with a maximum of 40 (6-stone) baskets * hour. A run at right angles confirmed this gradation, but, not very far away, trawl hauls yiel negligible quantities, even when water temperatures were between 2° and 3° C. There were qua ties of sponges there. On the North Cape Bank, the trawlers were fishing in a pocket of wate about 3·5° C. partly surrounded by water of over 4° C. No fish traces were seen on the ec sounding record throughout this cruise.

Cruise V (May 26–June 22) was noteworthy as being the first cruise during which the commer trawlers were observed to take advantage of the daily broadcasts of the ERNEST HOLT. They mo to where she had made good catches while fishing farther from the known concentrations of than the commercial vessels could afford to fish. As a standing practice, each day the ship iss on the W/T, such information as was thought to be of interest to trawlermen. The form of broadcasts is shown on the transmission pad (see Fig. 6), which is issued to trawlers on dema Plankton methods on this cruise were extended to the capture of larval fish and Euphausids. Th was very good fishing between WNW and SW of Bear Island, but poor fishing between SSW an Paying catches were associated with bottom temperatures from 1·5° C. to nearly 5° C., in dep varying from 90 to 160 fathoms. Echo-traces, presumably of cod, were abundant in the fis area. Many heavy fish traces were observed up to 60 fathoms above the bottom, which was at 170 fathoms, and these traces were found to be in temperatures of 3·4°–5·3° C., with cooler w on the bottom. The temperatures and some salinity samples, which were taken in the region of traces, indicated that the fish were in Atlantic water. Fish in the main concentrations were fee lightly, but some of those from the area of poor catches south of the island were feeding hea on Euphausids.

Cruise VI (July 6–August 2) was one on which the hydrographic sections were worked. thermograph giving a continuous record of surface temperatures was installed for the first time, good results were obtained. Good catches of fish feeding on Euphausids were taken near South-East Gully in temperatures of 1·5°–2° C., and very heavy catches (200–240 baskets) of feeding heavily on capelin (*Mallotus villosus*) were taken further east in water of 0°–0·45° C. Pa catches of feeding fish were also obtained in bottom temperatures below zero. This cruise sho that, in this area towards Hope Island where the fish were feeding on capelin, their distribution not governed solely by temperature. Commercial trawlers again made considerable use of ERNEST HOLT'S wireless information. Echo-traces of fish were not common. A new cod-en 110 mm. mesh was introduced and this cod-end mesh size has been used successfully ever since Appendix IV). An uncharted shallow area at the entrance to Fugloy Sound was surveyed and information passed on to the Admiralty.

Cruise VII (August 28–September 21). Widespread fishing was found towards and beyond H Island, but catches were never more than 20 baskets per hour. The bottom temperatures were a 1° C. To the south-east of Hope Island the fish were feeding on krill and some bottom-li

* In this report the English Arctic fishermen's practice of reporting quantities caught in baskets is followed thro out. A basket contains 6 stones, or 84 lb. avoirdupois. An arbitrary " paying level " has sometimes been tak 1 " bag," i.e. 40 baskets, or 1½ tons, per hour's trawling. The word " bag " refers to the average quantity that a takes on board in one lift.

MINISTRY OF AGRICULTURE & FISHERIES

ARCTIC RESEARCH PROGRAMME

Throughout each cruise the ERNEST HOLT will transmit daily at 2000 G.M.T. on 186 metres 1608K.Cs. her noon position: Lat..... Long.....
Depth..... Wind..... Sea..... Weather.....
.....Ice.....
Other information.....
.....
.....

She will listen for 10 minutes on the same frequency and trawlers are asked to pass on any information of interest and particularly what percentage of fish are feeding and whether their food is one of those pictured on this pad.

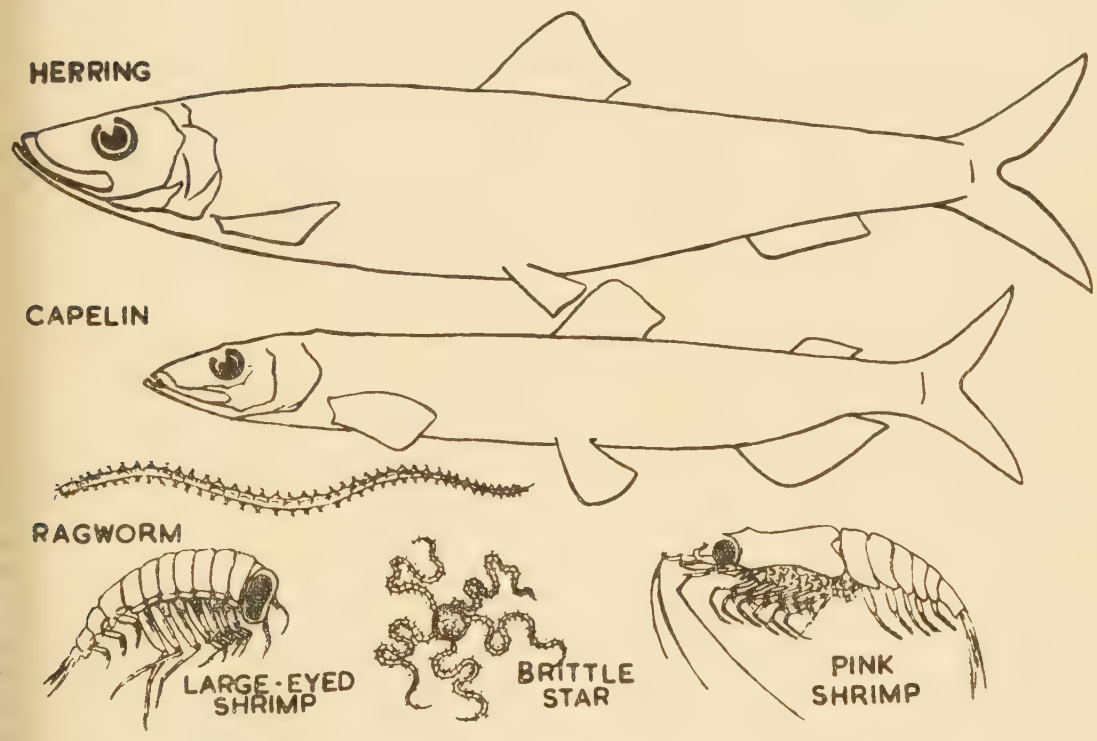


FIG. 6. R.V. ERNEST HOLT broadcast pad.

imals, but to the east of Hope Island capelin was the main food. The general impression was of arge population of cod widely dispersed for feeding. The hydrographic sections were worked ain.

Cruise VIII (October 2–27) began with a visit to Leith where the ship was inspected by delegates ending the meeting in Edinburgh of the International Council for the Exploration of the Sea. uring this cruise, Captain Ingham began the practice of drawing his own synoptic weather charts m data received by radio. This practice resulted then and thereafter in much more profitable of the ship's time. Reports from a group of trawlers that they were fishing in the North-West lly led the ship to their position, which turned out to be 40 miles further north, in the Stor- jord Rinne. About 60 per cent of the catch consisted of haddock, and the best catches were from ter of 3·0°–3·5° C., but no relation with temperature was shown by the observations. Trawling

in the North-West Gully, and to the southward, showed a distinct concentration of cod ab half-way along the southern edge of the gully where the temperature was close to 4° C. T concentration of fish was found to be near relatively sharp temperature gradients.

On Cruise IX (November 15–December 6) an attempt was made to draw together the thre from previous cruises, and put to the test such theories as resulted. It was observed that the s had taken paying catches of cod only when the bottom temperature was above 1·75° C., with exception of occasions when the cod had been heavily feeding on grounds between the SE G and the area of Hope Island. This lower limit of favourable temperature proved on all the cru up to the end of 1950 to be a sound basis for generalization, and need not be referred to ag Another tentative generalization was that on grounds from W to NW of Bear Island, paying catc had nearly always been in areas where water of above 5° C. was not far away from water of 2 This form of statement was proved on this cruise to be of no use for predicting catches. A be interpretation of the data was that, at certain seasons specified, water of the West Spitsber Current, which impinged on the Bear Island Bank, was favourable to good catches. Areas in wh this occurred were indicated by the 3·75° C. bottom-temperature isotherm. This interpretat provided, in practical terms, an hypothesis for testing in 1950. Cruise IX also made its own c tribution in a remarkable and, within the scope of the observations, an almost perfect associat of heavy catches with a particular hydrographic structure, colloquially named a " trap," in wh cold water lay over warmer water on the bottom. This structure is shown diagrammatically Fig. 7, using the usual arbitrary level for a paying catch, and taking the limit of unfavourably c water as 1·75° C.

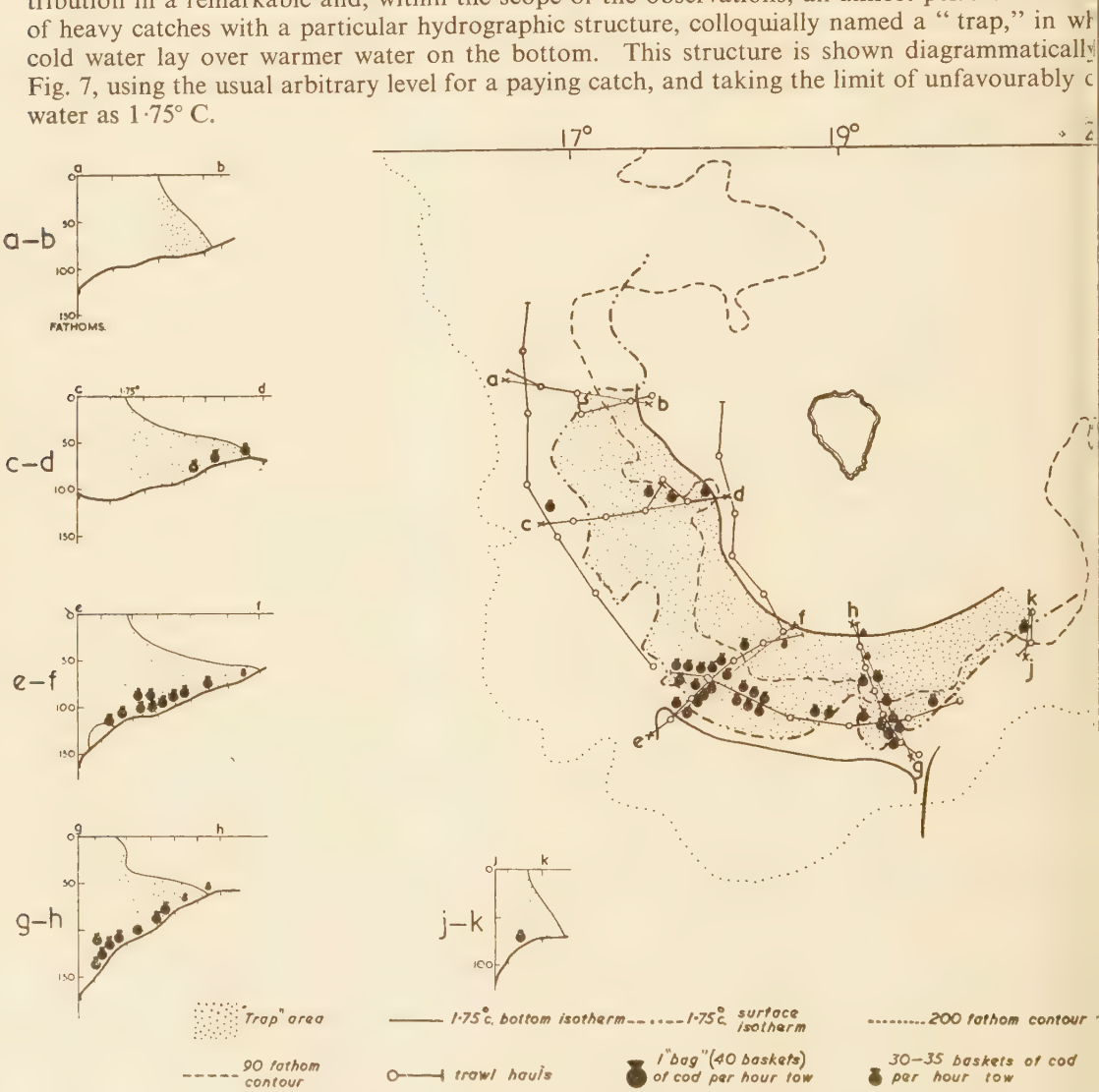


FIG. 7. The " Trap " hypothesis, Cruise IX, 1949.
Sketch-chart showing the concentration of cod within the " trap " area.
a–b, c–d, etc.: vertical sections through the trap, taken along the lines of trawl hauls.

THE CRUISES—1950

After Cruise IX 1949, it was time to review the first twelve months of the work in order to draw :he programme for 1950. In the meanwhile, it seemed that some of the information obtained ıld be of interest to commercial fishermen, so a press notice was issued (Appendix VII (1)). results of the examination of the collections of hydrographic data, cod-otoliths, plankton, thos, and other material, are summarized for both 1949 and 1950 in the succeeding section of this ort. As the work of 1949 had not shown any immediate danger of a return to conditions colder ı those since 1928, it seemed better to continue to aim at more effective fishing, rather than to turn xploratory voyages in other areas. From the work of 1949, two hypotheses required confirmation:

1. that paying catches in spring and autumn on the Bear Island Bank were associated with intrusions of the warmer water of the West Spitsbergen Current
2. that local hydrographic structure could, as in Cruise IX, make the cod more easily caught in trawls owing to a tendency of the fish to avoid water of less than 2° C. when not feeding.

At the same time, there was the standing obligation to watch for cooling of the waters; and e was the possibility, too, of discovering variations in water transport, related to (1) above. s provided the third major item in the programme:

3. continuation of the hydrographic sections.

These three items would confine the work rather closely to the Bear Island Bank, where other s of research, e.g., otolith, plankton, and benthos studies could be continued; but if ice prevented , three other questions seemed worthy of investigation elsewhere:

4. [why are heavy trawl catches so rarely accompanied by echo-traces?]
5. [are the mature cod approaching the Lofoten Islands confined so as to form a narrow procession through " bottle-necks "?]
6. [how do other grounds in the Barents Sea compare with Bear Island Bank in fish/temperature relationship?]

As before, square brackets indicate items on which no substantial progress was made during year. One important change in procedure was necessary. Because the aim was to test hypoes which might lead to finding fish, work would not begin in an area in which trawlers were king, but with a bottom- and surface-temperature survey. From the survey, areas would be cted for trawling, designed to test the favourable temperature and " trap " hypotheses stated ve.

Cruise I (January 6–27). The most important result of Cruise I was to show that the "trap" ct, found on grounds south of Bear Island in the previous November, was no longer of great ortance. It is true that there was at times a similar structure of cold water over warm, and that observations suggested some effect of this on the catches, but, when combined with noting the ng of other trawlers, the evidence was of variable, patchy fishing, and of similar irregularity in hydrographic structure. On one day, January 11, fishing was regular and associated with the rographic structure, whereas two days later the fishing had become very irregular. After this ıge, the cod were found to be feeding lightly on the Ctenophore *Beroë*, which suggests that the were in mid-water, and might account for the irregularity of the fishing.

Cruise II (February 9–February 28). The work of this cruise was hampered by a large field of ı pancake ice extending over the Bear Island Shelf. The hydrographic structure was of the ap " form, from about the 100 fathoms line outwards, but good catches were made in only one ll part of the zone so covered.

Cruise III (March 10–April 4). Ice continued to hamper work in the middle of March, when the rographic sections were again carried out. On this occasion, three stations in the ice field could be worked. Although the temperature over most of the fishable area was between 2° and 3° C., ·ying catch was made in one haul only. This was south of the island. There was no apparent :ion between the distribution of the fish and the hydrographic structure. Several Greenland :ks (*Acanthorhinus carcharias*) were caught. This is a cold-water species which is believed by :rmen to scare away other fish.

On this cruise, on the initiative of the Master, the Hensen net procedure was modified to ov come the freezing of ropes, which seriously interfered with the normal counterweight method hauling. The new method, later known as the " Flying Hensen," was found to be successful a was adopted henceforward (see Appendix V).

Cruise IV (April 21–May 11) gave unexpected results, in that although there was neither go fishing nor any interesting hydrographic feature on the Bear Island Shelf, good catches of feeding on capelin were taken 90–120 miles to the ENE. This fishing was reminiscent of t during July 1949, but in rather deeper water of 2°–3° C. as opposed to water of about 0° C. in 19

Cruise V (May 22–June 10) was a close repetition of the corresponding cruise in June 1949. Th was very heavy fishing localized on the edge of the shelf W of Bear Island, where the bank beg to shelve steeply. The area covered by water over 2° C. was twice as extensive as that found June 1949, but the area of bottom water above 4° C. was very much less, and the maximum bott temperature not so high. The area of heavy catches was much smaller, but there was a wide a of light fishing suggesting that the fish were more dispersed than in 1949. Some strong ec traces were obtained, but it was impossible to identify them with certainty, because both cod redfish (*Sebastes marinus*) were abundant in the area. On the whole, the fish were feeding c lightly on Euphausids.

Cruise VI (June 20–July 12). For the first time since being commissioned, the ship was una to carry out any part of her trawling programme. After completion of the hydrographic sectio an air pump in the engine room gave trouble, and it was considered inadvisable to attempt to tra A temperature and plankton survey was therefore made, and the positions and reported fishin trawlers noted. These appeared to be unrelated to hydrographic features, which were not v marked. A special feature of the plankton was the widespread and abundant occurrence of Pteropod Mollusc (*Limacina helicina*), known to the fishermen as " black snails." The cod v reported to be feeding heavily on this animal, which was undoubtedly the cause of the " stinking ".

Cruise VII (July 30–August 19). The whole of the shelf W of Bear Island was covered with tom water of over 2° C., and the fishing was poor over most of the area. A paying catch was obtai in one position where the water was from 3·5° to 4° C. An experiment with a shrimp-netting co on the back of the cod-end was successful in catching small cod down to 7 cm. in length. A fea of the cruise was the study of the associations of bottom animals in various depths and bottom t peratures around Bear Island.

Cruise VIII (September 25–October 18). The hydrographic sections of this cruise reve warmer water than had been encountered in mid-September 1949, at all depths on the Bear Isl Bank. An extensive survey of bottom temperature revealed three patches of warm water of 4 or over. One of these, south of the island, was not tested by trawling; one small patch SW of island did not yield good fishing, but one in the NW Gully gave paying fishing near one end. Du the cruise cooler water pushed southwards at the surface. At one station south of the islan slight decrease of temperature with depth was turned into a marked increase: this was perhaps beginning of a " trap " structure such as that observed in November 1949. The change, kn to have taken place between October 2–6, was probably brought about by an easterly gal October 2 and 3. This showed how quickly a " trap " could be formed. On this cruise, an exter echo-trace was observed similar to that of the " deep-scattering layer " in the open oceans (E & Lee, 1951).

It was noticed that where the traces were found, the cod were feeding on herring. In the No West Gully, where the best catches of cod were taken, a few herring were taken in the trawl.

Cruise IX (November 6–December 12), like that in November 1949, was designed to b together the studies on temperature and fishing made during previous cruises. The working t was divided into two parts, November 13–23 and November 27–December 3—refuelling Tromsoe necessitating the break in the middle of the cruise. Fishing was very slack, n yielding more than 30 baskets per hour and frequently giving only 20 baskets as the best c in a locality. On this cruise, the " trap " area was much smaller than that found in Noven 1949, and was in much shallower water. The " trap," however, did yield the highest catches of cruise. The latter part of the cruise was devoted to testing the hypothesis that fish might be a ciated with intrusions of Atlantic water (4° C.) from the West Spitsbergen Current on to the

land Bank. The evidence obtained, though not conclusive owing to the general poor level of shing, tended to support this hypothesis. Plankton and benthos samples were collected in the eas fished. A north-east gale accompanied by extreme cold finally brought work to an end.

PROGRESS

sh-temperature Studies

This subject has been dealt with in the previous sections and may be briefly summarized here. ne original idea of a favourable range of temperature of 2° to 4° C. was found to be of little signi-ance, in that there was often a large area of fishing ground covered with water of this temperature nge, but not yielding paying catches of cod. Furthermore, from July to October, heavily feeding od were often caught in large quantities in water around 0° C., and their movements then seemed be independent of temperature. At other times, the fish were usually not feeding and their ovements tended to be more influenced by temperature. West of Bear Island, water of around C. seemed to be favourable for the concentration of these fish, while south of the Island the vourable temperature was around 2° C. A fuller account of this subject is given in the Press elease of March 1951, reproduced in Appendix VII (2), to which the reader is referred. A more idential account with a fuller discussion of the hydrography is in Lee (1952); but an outline of e main hydrographic findings is given below.

cho-sounding

In the first programme drawn up in 1949, highest priority was given to echo-sounding. It was oped that the echo-sounder might prove as valuable an aid to searching for Arctic cod as it has r pelagic fish in Home Waters. This hope has not been fulfilled. Traces likely to have been used by cod were only detected in the summer months, and then only in areas where cod were in ry high concentrations. Widespread echo-traces have frequently been recorded, but identification their cause has on the whole proved baffling. In addition to those of cod, traces caused by rring, capelin, and redfish, have on occasion been identified with some degree of certainty. A ace subject to a diurnal vertical migration—rising at night, sinking in daylight—was recorded in ruise VIII, 1950, and has been reported elsewhere (Burd and Lee, 1951). A sounder with a fre-ency of 10 kilocycles per second was found to give better results than the usual 14 Kc. machine.

ydrography

Observations made during the cruises of 1949 and 1950 enabled the sequence of hydrographic ents in the Bear Island area to be described by Lee (1952). Estimates of the transport of water ross the standard sections have shown that conditions on the Bear Island Bank, at any ne time, depend upon the relative strengths of the Atlantic and Arctic influences at that time id during the preceding few months. On the whole, temperatures are higher when the Atlantic flux has been strong in the summer. For example, the Atlantic influence was stronger during the mmer of 1950 than during that of the previous year, and resulted in higher temperatures on the ear Island Bank in the summer and autumn months of 1950. On the other hand, the Atlantic fluence in March 1949 was much stronger than that in March 1950, but this caused lower tem-ratures to prevail on the bank in the spring and early summer of 1949. The explanation seems be that a strong Atlantic influx early in the year results in the formation of an homogeneous ater column of a rather high salinity over most of the bank. Such a condition is favourable for the tablishment of a winter vertical circulation, which leads to " cascading " when the water on the nk has become sufficiently cold and heavy to flow to the edge of the shelf and run down the ntinental slope. This process causes bottom temperatures on the fishing grounds to be lower an when cascading does not occur. It is also partly responsible for the formation of the bottom ater in the Bear Island Channel.

The work also shows the importance of the south-westwards advance of the Arctic water in the tumn. When a powerful advance occurs, a surface layer of low salinity and temperature pushes to the south-westwards over warmer and more saline water. This sets up a structure that reduces nvectional mixing, because surface water of salinity 34·6 ‰ will still be less dense, even when oled to nearly freezing-point, than bottom water of salinity 35 ‰ and temperature 3° C. A ong surge of Arctic water thus prevents cascading. Such an advance took place in the autumn 1949, and the resulting structure did not disappear until March 1950. This factor, together with e fact that the Atlantic influence in the spring of 1950 was weak, accounts for the absence of

cascading in 1950, and the higher bottom temperatures that prevailed in the spring and ear summer of that year.

Another result comes from the almost continuous use of a recording thermometer since th summer of 1949. This has allowed an appreciation to be made of the changes that take place i the surface temperature distribution throughout the year. The most spectacular features are th extremely sharp gradients that are found at the polar fronts, to the west and south of Bear Islan Here changes of temperature of 6° C. in half a mile were commonly observed in the montl November–March, and on occasions, changes of 5° C. in 400 yards have been recorded. To dat there has been no way of obtaining a continuous record of temperature for water close to th bottom, but spot observations at close intervals have revealed changes of temperature of 1·5° (per mile. These sharp temperature gradients near the bottom were found chiefly on that part the Bear Island Bank to the west of the 19 deg. E meridian, owing to the proximity of the We Spitsbergen Current. Here the temperature at the bottom ranged from minus 1° to 5° C., where to the east of the 19 deg. E meridian, the bottom was covered with water of rather uniform temper ture between minus 1° and 2° C., and sharp temperature gradients were rare.

A beginning was made in the study of the nutrient salt distribution. According to the observ tions made, the phosphate content of the water can reach very high values, but the methods use were not entirely satisfactory, and, at the time of writing, still need establishing on a reliable basi The results of the determinations of the dissolved oxygen content showed that the Atlantic wat had a high oxygen content, with a saturation value of over 90 per cent. The bottom water of th Greenland Sea also gave high oxygen values such as 6·8–7·0 ml/L at temperatures just below zer These correspond to a saturation of about 85 per cent, consistent with the idea that this botto water is renewed by the sinking of surface water which is greatly cooled in winter. The oxyg content of the Arctic water was about 8·0 ml/L at temperatures between minus 1° and plus 1° (corresponding to a saturation of about 100 per cent. It appears, from the results so far obtaine that in summer the entire surface of the western Barents Sea had an oxygen content above 1(per cent, the average being about 105 per cent. This was due to photosynthesis. An oxygen mir mum sometimes occurred below the photosynthetic zone at a depth of approximately 100 metr perhaps owing to the uptake of oxygen by decaying plankton. In autumn the saturation value the surface layers decreased to between 90 and 100 per cent as photosynthesis diminished ar winter cooling and vertical mixing began. Cascading in winter and early spring carried water wi a high oxygen content (its saturation value being over 95 per cent) down the continental slop This process increased the oxygen content of the bottom water in the Bear Island Channel and the fishing grounds to the west of the island.

Otolith Studies

The collection of cod otoliths was in the first place incidental to fish and temperature, and oth biological studies. Otoliths were collected from each trawl haul and examined for age. (The a of the fish is indicated in the otoliths by alternating opaque and hyaline rings.) It soon becar apparent that the otoliths could be divided into a number of different types on the basis of differenc in the structure. The samples were therefore re-examined, and it appeared that in the Bear Isla area two types predominated. The first of these was easily readable and characterized by t uniformity of its ring structure. This has been called by Rollefsen (unpublished work) the " Sv bard " or " Western " type (see Plate IV). The second type differs only in the sub-division of t opaque summer zones by one or more narrow hyaline " check " rings. This has been called t " Split-ring " or " West (Split) " otolith (see Plate IV). Other types occurred in small numbe their geographical distribution suggesting that the fish were intruders at Bear Island. Since th importance increases further east, they have been grouped together and labelled " Eastern " typ

The cruises of July and September 1949 showed that towards Hope Island the " Split-ring fish predominated over the "Western" type, which was only found in abundance to the west of Be Island. The plotting of the geographical distribution of the two main types of otolith (see Fig. led to the tentative hypothesis that the cod concentration, upon which the Bear Island fishery based in the months of October to January and May and June, separates for feeding into two ma groups. One, composed of "Western" type fish migrates to Spitsbergen in or near the West Spi bergen Current. The other group, composed of " Split-ring " fish, moves into the cold water towar Hope Island, to feed—mainly on capelin. The return migration usually brings the two grou together again at Bear Island from October onwards. This hypothesis fits the seasonal moveme

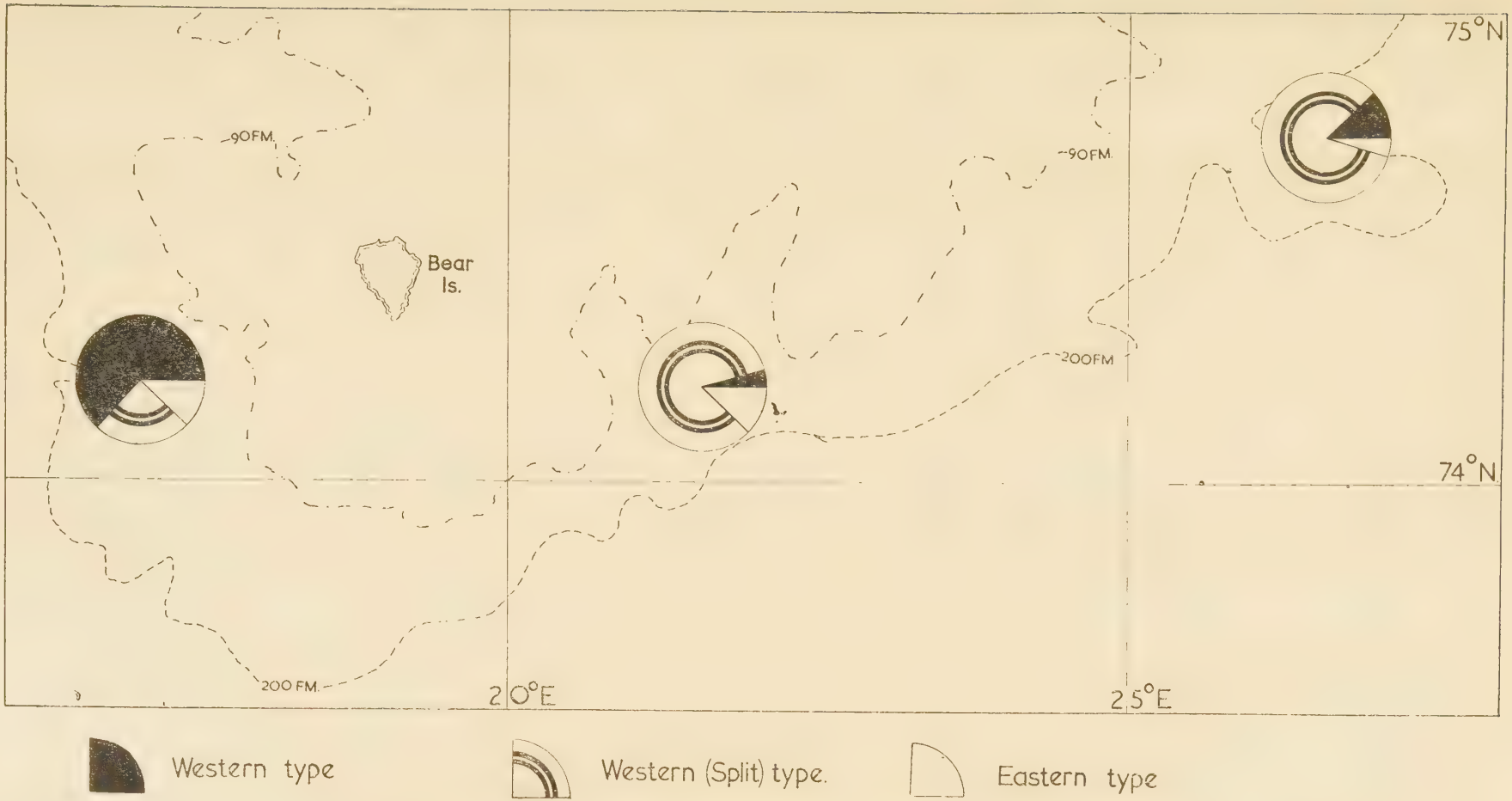


FIG. 8. Distribution of otolith types in the Bear Island region in early summer (Cruise IV, 1950).

of the fishery around Bear Island, and has been arrived at independently by Maslov (1944) fro consideration of the movements of the fishery and the length distributions of the fish.

The testing of this hypothesis by a series of marking experiments and by fishing in select areas at Spitsbergen and Hope Island in and out of the feeding season, was begun in 1951 and continuing at the time of writing.

Fish Food

Observations on the stomach contents of samples of cod were made at nearly all trawl static throughout the period. The main types of food were Crustacea and fish. Of the Crustac Euphausids and Hyperiid Amphipods were the most important type of food. The prawn *Panda borealis* and the crab *Hyas araneus* were important at certain times of the year, but only in certa areas. Amongst the fish, capelin was by far the most important food organism, although herri and small codling were frequently found. The Pteropod Mollusc *Limacina helicina* became imp tant for a short time in the summer of 1950, and other planktonic species such as the Ctenoph *Beroë* (" jellies ") and the Chaetognath *Sagitta* (" arrow-worms ") were taken occasionally. Hea catches of cod were rarely associated with full stomachs, except in the area extending from t south-east of Bear Island to Hope Island. In this area large catches of heavily-feeding fish w made in July 1949 and April–May 1950; the food showed a gradual change from Euphausids o at Bear Island, to capelin—characteristically—in the Hope Island region.

The nature of the main food organisms, capelin, herring, Euphausids, Amphipods and Pterop —all of which are planktonic or free-swimming mid-water species—suggests that the cod, too, ha mid-water or pelagic habit and is not a true bottom-haunting species (Brown and Cheng, 1946)

Plankton

The spring outburst of growth and reproduction in the plankton was found to be well mark in these latitudes. The hauls along the hydrographic sections showed that off the coast of Norw in 1949, the greatest density of zooplankton was in early June, while on the outer parts of the B Island Bank it was a month later. In 1950, hauls were made more frequently, but were confined the stations north of 73 deg. N. They gave heavy catches of zooplankton in the West Spitsberg current in May and in early July, while in the cold water close to Bear Island the greatest den was in early August. In the area of mixing over the banks, the maximum was less than either the warm or cold water, and was intermediate in time. The maximum development phytoplankton was usually about a month earlier than that of the zooplankton.

A study of the distribution over a wider area of the zooplankton species, both from the Hen net and the stramin net hauls, shows that the commoner species can be divided into three m groups: (1) those that are found all over the area from the warm Atlantic water of the West Sp bergen Current to the cold Arctic water as far north as Hope Island: these include *Aglantha digit Calanus finmarchicus*, and *Themisto abyssorum;* (2) those species which are found mainly in Arctic water, of which the commonest are *Beroë* and *Bolina*, *Sagitta arctica*, *Themisto libell Limacina helicina* and *Oikopleura vanhöffeni;* (3) those of the warm oceanic water of the W Spitsbergen Current, such as *Eukronia hamata*, *Calanus hyperboreus*, *Limacina retroversa* a *Oikopleura labradoriensis*. Over the banks to the west and south of Bear Island where there i mixing of the water masses, a mixture of species of all three groups is found. The distribution of Euphausids of the genus *Thysanoessa* seems to depend mainly on depth. In water of less th 100 fathoms *Th. inermis* is common, beyond the 200-fathom line the smaller *Th. longicaudata* found, while between 100 and 200 fathoms there is usually a mixture of the two species.

Benthos

Although the original programme did not include a study of the benthos of the Bear Isla region, this work was started in June 1949, and collections of benthos have been made on m cruises since then. Apart from occasional hauls with the Agassiz trawl, no special attempts h been made to sample the benthos, the otter trawl with its shrimp-netting cod-end cover hav been found to give a reasonable sample of the more important animals. It has been found t some of the shrimps give a good indication of the type of water in which the haul was made. T it has been noted that *Sabinea sarsi* is characteristic of the warm Atlantic water and *S. septe carinata* is the species found in Arctic water. The two species intermingle to the W and NW

ear Island where the two types of water mix. Several hundred species of bottom animals have been entified, and a further study of their distributions will probably reveal other species indicative the two main water masses.

Two benthos zones in which good catches of cod were rarely made are the sponge or "duff" *Geodia sp.*) zone in the deeper water (150–250 fathoms) W and SW of Bear Island, and the "white eed" (*Alcyonidium spp.*) zone in shallower water (60–90 fathoms). Whether the general paucity catches in these areas is a function of the depth or temperature, or is due to some noxious effect the animals themselves, cannot yet be stated.

opulation Studies

A beginning was made in 1950 on a study of the mortality and growth rates of the Arctic cod, ese being the basic data required for population assessments. This work required regular sam- ing, on the market, of length and age-distribution, but certain problems needed solving before mpling could begin, notably in the determination of the age of the fish. The usual method, by eans of otoliths, would have involved extensive heading of fish on the market and a special staff do it. Moreover, until the early part of 1950, the bulk of the commercial catch was headed at a. An alternative method, permitting large-scale sampling on the market with the minimum delay and mutilation of the fish, had to be devised.

Of the various structures that have been used for age-determination, fin-rays seemed most likely meet the present requirements (Boyko, 1946). An initial investigation of the rays of the various is of the cod showed that those of the first dorsal fin had the most clearly marked annular structure, hich corresponded in a reasonable degree with the otolith structure. There were, however, rtain important discrepancies. At this time, too, the structure of the otolith itself was found to ow regional differences which rendered the whole question of age-determination somewhat certain. It was clear therefore, that a representative collection of fin-rays and otoliths covering seasons and all important areas would be required before the accuracy of the ray structure for e-determination could be assessed. This could be done only in the ERNEST HOLT, so in 1949 and 50 both otoliths and fin-rays were taken from the fish samples.

The use of fin-rays was nevertheless sufficiently promising to justify starting their collection on e market. This was begun in 1950. The collection of these market data is being continued, and eir analysis awaits the results of the findings from the material collected by the ERNEST HOLT.

avigation

Observations made by the Master of the ERNEST HOLT have resulted in improvement in naviga- nal information for the Bear Island and other areas. The British tidal information for Bear and was found to be out of phase. The time of High Water at Bear Island can now be obtained adding 1 hour 48 minutes to H.W. at Heligoland. This correction has been adopted by the dmiralty. A further contribution was the discovery and surveying of a shallow area at the entrance Fugloy Sound, North Norway. The ship's position has always been given in the daily broadcast, abling skippers of other trawlers to check their own position roughly by taking a radio bearing the ERNEST HOLT. Experience showed that, until radar was installed, it was difficult to maintain ition on grounds south of Bear Island when out of sight of land, because Mount Misery obscured e transmissions of the Bear Island radio station.

e Programme for 1951

At the end of 1950 it was concluded that it would not be profitable to continue the close study the Bear Island fishery at all seasons of the year. As the main results had received sufficient nfirmation, it was decided that the needs of the fishery could best be served by extending the search to areas not usually visited by commercial fishermen because of the sacrifice of time quired to steam to them, having in mind the uncertainty of finding fish. The programme for 1951 erefore provided for the study of migrations of the cod to and from the Spitsbergen and Hope and areas, and of the concentrations of cod feeding on particular organisms, particularly capelin. ese were the main projects. The West Bear Island hydrographic section would be continued in njunction with the main projects, so that there would be no interruption of the studies of the ative effects of Atlantic and Arctic water on the Bear Island Shelf.

Conclusion

The first two years saw Arctic fishery research firmly established, having opened up several lines of research, and with practical results from the main study of cod and temperature; but degree to which these results would, on the one hand, be applied in commercial fishing, and on other hand, prove applicable in other Arctic areas, was as yet unknown.

REFERENCES

Boyko, E. G., 1946. Age determination in fishes, based on examination of finray sections. *C.R. Sci. de l'U.R.S.S.*, N.S. **53** (5), 483–4, Moscow.

Brown, W. W., and Cheng, C., 1946. Investigations into the food of the cod (*Gadus callarias* L.) off Island, and of the cod and haddock (*G. aeglefinus* L.) off Iceland and the Murman Coast. *Bull. Mar. Ecol.*, **3** (18), Hull.

Burd, A. C., and Lee, A. J., 1951. The sonic scattering layer in the sea. *Nature*, **167,** 624–6, London.

Holt, E. W. L., 1892–95. North Sea Investigations. *Journ. Mar. Biol. Assoc. U.K.*, N.S. **2** and **3,** Plym

International Council for the Exploration of the Sea, 1949. Bibliography. *Cons. Perm. Inte Explor. Mer, Rapp. et Proc.-Verb.*, **125,** 42–52, Copenhagen.

Lee, A. J., 1949. The forecasting of climatic fluctuations and its importance to the Arctic fishery. *Perm. Internat. Explor. Mer, Rapp. et Proc.-Verb.*, **125,** 40–1, Copenhagen.

——, 1952. The influence of hydrography on the Bear Island cod fishery. *Cons. Perm. Internat. Ex Mer, Rapp. et Proc.-Verb.*, **131,** 74–102, Copenhagen.

Lumby, J. R., and Lee, A. J., 1949. Oceanographical features of the Barents Sea. The Challenger So *Abstracts of papers read at Joint Meetings*, **3** (1), 13–14, London.

Maslov, N. A., 1944. The bottom-fishes of the Barents Sea and their fisheries. *Trans. Knip. Pola Inst.*, **8,** 3–186, Moscow and Leningrad.

Robertson, J. A., 1932. A cursory survey of the Bear Island trawling ground. *Cons. Perm. Inte Explor. Mer, Rapp. et Proc.-Verb.*, **81,** 115–39, Copenhagen.

Rollefsen, G., 1948. The Arcto-Norwegian stock of cod. *Cons. Perm. Internat. Explor. Mer, Rap Proc.-Verb.*, **122,** 7–8, Copenhagen.

Sund, O., 1932. On the German and Norwegian observations on the cod in 1931. *Cons. Perm. Inte Explor. Mer, Rapp. et Proc.-Verb.*, **81,** 151–6, Copenhagen.

Thompson, H., 1933. Relationship of cod catches to water temperature. *Rep. Newfoundland Fish. Comm.*, **2** (1), 74–80, St. John's.

——, 1943. A biological and economic study of cod (*Gadus callarias*, L.) in the Newfoundland including Labrador. *Newfoundland Govt., Dept. Nat. Resources, Res. Bull. No.* 14, St. John's.

APPENDIX I

COD-MARKING EXPERIMENTS OF THE LATE F. M. DAVIS

The late F. M. Davis made two cod-marking trips to Bear Island and Spitsbergen in the KINGSTON AMBER. During the first and most successful trip in October 1937, 474 cod were ma in two areas in the Spitsbergen region: (*a*) W of Hornsund, (*b*) SE of Sorkapp. Of these, 18 were recaptured as follows:

8 in the vicinities of marking within 30 days of being released

1 60 miles NW of Bear Island 33 days after release

1 40 miles SW of ,, ,, 62 ,, ,, ,,

2 during the Lofoten fishery in spring 1938

2 50 miles E of Bear Island in July 1938

4 in the marking areas June–September 1938

The second voyage was in October 1938 when 520 fish were marked about 120 miles EN Bear Island. Of these, only 5 were recaptured, all within 30 miles of the marking area and wi 20 days of release.

Davis made a third marking trip in May 1939, this time to the Murman coast and Skolpen E areas. About one hundred each of cod, haddock, and plaice, were marked. None was recapt owing to the cessation of fishing during the war.

APPENDIX II

GEAR IN USE AT THE END OF 1951

ological Gear

" Flying " Hensen Net (see Appendix V)

' International " Standard Plankton Nets—fine and coarse silk (reference Ostenfeld and Jespersen, 1924: " Standard Net for Plankton Collection ", Publication de Circonstance, No. 84,

1 and 2 metre stramin tow-nets

1 and 2 metre mosquito-netting tow-nets

(When stramin and mosquito-netting tow-nets are used, a Kelvin sounding-tube is sent down as a messenger to record the depth of towing.)

1½ metre Agassiz trawl—shrimp-netting with stramin cod-end

Otter trawl (see Fig. 9) with and without Vigneron-Dahl gear. 110 mm. mesh cod-end with shrimp-netting cover

Mosquito-netting and shrimp-netting cover on square of trawl

Guillotine for otolithing fish (see Fig. 10)

Echo sounders: M.S. 24, 10 Kc. and 14 Kc.

ydrographic Gear

Nansen reversing water bottles

Ekman/Munro reversing water bottles (used as a reserve only)

Reversing thermometers (Negretti and Zambra: Richter and Wiese: Kahl)

Bathythermographs (Admiralty type: 450 ft. model)

Munro "Discovery" type oceanographic davit

Reversing frames

Lumby surface sampler

Negretti and Zambra transmitting thermograph

· mm. wire. 7 × 6 drawn galvanized. Breaking train 19·9 cwt.

$\frac{5}{2}$" Wire. 7×14 stainless steel. Breaking strain 0 cwt.

½ h.p. steam winch

8 h.p. steam winch

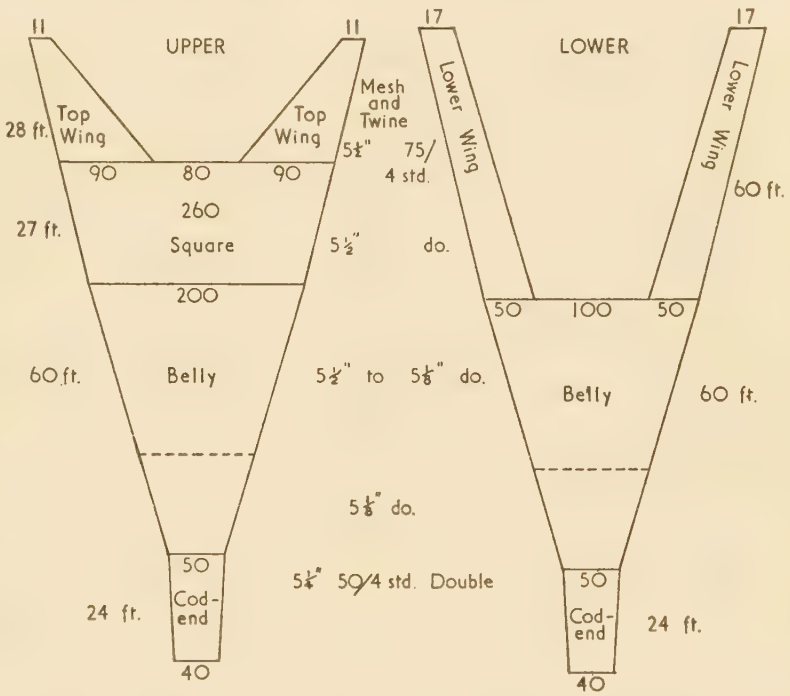


FIG. 9

The R.V. ERNEST HOLT's trawl using the new 110 mm. cod-end mesh.

Length of Headline: 78 ft.

Length of Ground Rope: 116 ft.

Square	260/200	5½ in.	Manila 75/4 strand	27 ft.
Top wings	90/11	5½ in.	,, 75/4 ,,	25 ft.
Lower wings	200/50/17	5½ in.	,, 75/4 ,,	60 ft.
Belly top	200/50	5½–5⅝ in.	,, 75/4 ,,	60 ft.
Cod-end	50/40	5¼ in.	,, 50/4 ,,	24 ft.

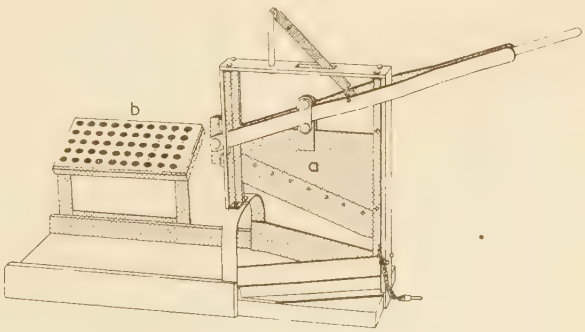


FIG. 10. The otolithing guillotine.

a—the blade; b—removable tray for the otoliths.

APPENDIX III

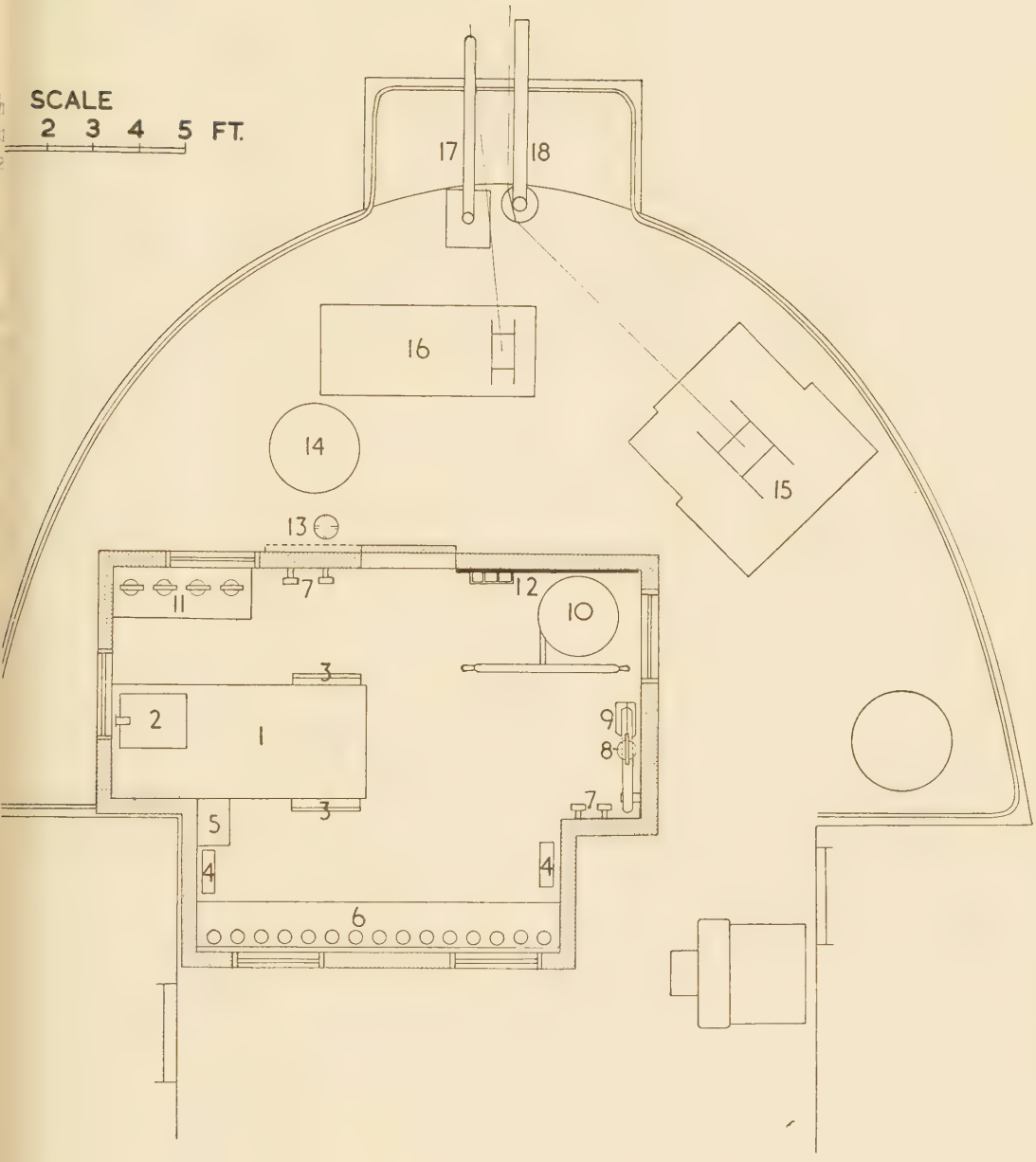
THE HYDROGRAPHIC LABORATORY

The hydrographic laboratory was originally situated amidships and formed the starboard of the deck laboratory. A 2 h.p. electric winch fitted on the engine-room casing immediatel of the starboard door of the deck laboratory, was used for hydrographic work. An H-sh girder, which was also fitted on the engine-room casing and which could be racked outboard the wire clear of the ship's side. An accumulator was incorporated in the girder, and a meter w was fitted at its outboard end, whilst a flexible drive connected the meter wheel to a tachom near the winch switch gear on the wheelhouse verandah.

This arrangement was used for nearly two years during which time many difficulties bec apparent. In the first place, the winch could only carry 450 fathoms of wire, and this limitec depth at which samples could be taken. Furthermore, the winch was not sufficiently powerful the rate of hauling was low. It was impossible to replace it by a bigger winch as there was sufficient space on the engine-room casing near the working position. The most serious draw lay in the fact that it proved impossible to manœuvre the ship on station so as to keep the vertical. The ship had to lie beam-on to the wind and sea, with the result that in winds a Force 4, excessive wire angles were experienced. Moreover, much water was shipped over weather rail when more than a moderate sea or swell was running, so that hydrographic wo the amidships position became both wet and dangerous.

At the end of 1949 it was decided to attempt to carry out hydrographic work over the from the after boat deck, this appearing to be the most suitable alternative position. A $2\frac{1}{2}$ steam winch, a platform and a small swan-neck davit were fitted in this position, and the suitat of these arrangements was tested during 1950. Although large wire angles were still experier gear could now be more easily worked as the wire led across the operator instead of away from Moreover, the position was dry. The wire did not lead near the propeller, which is some dist forward of the taffrail. At the end of 1950 it was decided to make this the permanent hydrogr working position, and a new hydrographic laboratory (see Fig. 11) was erected on the after deck. It also houses the emergency steering position, in the port after corner. The labor is constructed of aluminium, in order to reduce top-weight. The bulkheads are insulated silicated cotton, and the deckhead with cork, the whole being lined with plywood. The de provided with scuppers and is covered with gratings. A rack, especially designed to allow handling of 15 Nansen water bottles, runs along the length of the forward bulkhead (see Plate and stowages for four Ekman/Munro water bottles, the reserve thermometers, reversing fra messengers, clinometer, and a blackboard, are provided on the after bulkhead. The water-b racks are fitted with ready-use stowage for sample bottles, and are illuminated by adjustable la Stowages for a stop-clock, Nansen-Pettersson water bottle, a bathythermograph, and two reve frames, are fitted on the port bulkhead, and an apparatus for adding reagents for the servation of dissolved oxygen samples is sited to starboard. An athwartships bench, with a sink freshwater tap and with drawers and room for sample-bottle stowage below, is fitted in the board half of the laboratory. The laboratory is heated by means of two steam radiators a ventilated by a mushroom ventilator in the deckhead.

The $2\frac{1}{2}$ h.p. winch and the swan-neck davit have been retained for light work, such as b thermograph and frame lowerings, while an 18 h.p. steam winch and a " Discovery " type oce graphic davit for heavier work have been added. Steam winches are preferred to electric win because experience with the latter has shown them to be unreliable in Arctic conditions, as the susceptible to damage by water; although, on the other hand, steam winches do not allow su fine control over the speed of hauling, and can freeze-up in cold weather. The smaller steam v has worked well under all weather conditions, and the larger winch is now performing satisfact although some initial trouble with freezing-up was experienced, and the drain-cocks had t modified. The after working position is fitted with canvas dodgers for cold weather, and is pro with a good lighting system, a ready-use bucket stowage for the bathythermograph, and a read stowage on the rail for the terminal weight of the hydrowire. Both davits can be turned inboa allow easy access to the sheaves. This new hydrographic working position has proved very factory, and has allowed work to be carried out easily and quickly, and with confidence.



Key: 1. Bench with drawers and stowage space underneath.
2. Sink with freshwater tap.
3. Folding seats.
4. Radiators.
5. Dissolved oxygen apparatus.
6. Nansen water-bottle rack.
7. Reversing frames.
8. Nansen-Pettersson water-bottle.
9. Bathythermograph.
10. Emergency steering wheel.
11. Ekman water-bottle rack.
12. Blackboard.
13. Bathythermograph stowage.
14. Ventilator.
15. 18 b.h.p. hydrographic winch.
16. 2·5 b.h.p. hydrographic winch.
17. Swan-neck davit.
18. Oceanograph davit.

FIG. 11. After boat-deck of the R.V. ERNEST HOLT showing the arrangement of the hydrographic laboratory and working position.

APPENDIX IV

TRIALS OF A 110 mm. COD-END MESH

Trials of cod-ends of 110 mm. mesh were carried out during Cruises VII, VIII, and IX, The first cod-end to be tested was braided from manilla twine of 60 yards per pound, with sisa line meshes. Towards the end of Cruise IX, a cod-end of stouter twine (50 yards/pound), a larger margin of safety was used. Cod-ends of this stouter twine and of 110 mm. mesh with cod-line meshes have since been used for all fishing by the ERNEST HOLT.

The figures below were obtained during the tests on the three cruises mentioned above.

	60 *yd./lb. Manilla twine* (*Sisal cod-line meshes*)	50 *yd./lb. Manilla twine*
Period of use	7 weeks (intermittent use)	November 27 and 28. (I until Cr. III/1950, St. 63.)
No. of hauls	73	7
Maximum weight lifted	100 baskets	*100 baskets
Hours fishing	106	12¼
Kits brought on board.	900 (1,051 caught)	327 (1,275 caught)

APPENDIX V

THE "FLYING" HENSEN

During Cruise III 1950 the extreme cold seriously interfered with the normal counter method of working the Hensen net, because the ropes froze on exposure to the air. To ove this the following modifications were made.

Thirteen trawl floats were attached around the canvas frame as shown in Fig. 12. The n attached to a wire carrying the counterweight "pen" by means of an iron hoop and a thermo reversing frame. The net was lowered to the required depth and a messenger was sent down to operate the frame. This released the net, leaving it free to float to the surface although still attached to the wire by the iron hoop. The rate of ascent, which was entirely independent of the ship's motion, was $\frac{1}{3}$ metre per second.

This method was used again on the following cruise, but owing to difficulties with the release mechanism a further modification of the method was needed. The net was attached to the pen by 8 ft. of line and lowered to the required depth. The pen was then hauled up slowly by the winch at the required speed. The buoyancy of the net and the length of the line counteract irregularities in the hauling speed caused by the ship's motion. This method has been used on all subsequent cruises.

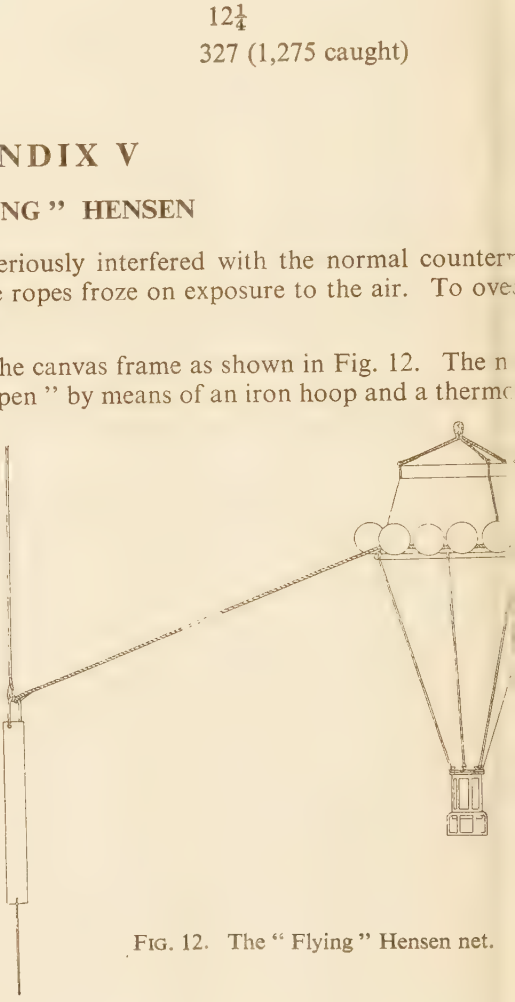


FIG. 12. The "Flying" Hensen net.

The size of the winch makes speed control difficult at times. The first method with t ascending freely is the more desirable, and a new release mechanism is being tried at the t writing.

* To test strength of cod-end; catch found to include a large stone.

APPENDIX VI

STANDING INSTRUCTIONS IN USE AT THE END OF 1951

1. Arctic Plankton Instructions

nic Production

) *All cruises*

wo hauls with Hensen net from 100 metres to the surface to be taken at stations V, U, S, Q, and Nx; Mx; M, L, K, H and G. (For positions see under Section 2, Hydrographic Instructions v.) One catch to be preserved in formalin, second to be filtered and dried for dry weight and fat mination.

) *Sections*

/hen hydrographic sections are worked, plankton should be taken as above with the addition ıe Fine Net haul from 50 metres to the surface at each plankton station.

) On cruises towards Spitsbergen, other lines with Hensen and Fine Net stations 10 miles ., running east and west, north of the present " West Bear Island Section," should be done at iscretion of the Naturalist-in-Charge.

) Similarly, on cruises towards Hope Island, lines should be done running roughly NW and f the bank.

ill "

lauls with 1 metre (or 2 metre) stramin net to be made as convenient in the fishing area. s should be made as near the bottom as possible or at the depth of an echo trace of feeding (Occasional surface tows in daylight and dark would be useful for comparison with deep s.) Please note in log book for each haul:

(*a*) Length of wire out

(*b*) Depth of steady tow (by Kelvin tube)

(*c*) Time of shooting
Time finished shooting
Time began hauling
Time finished hauling

ıach Contents

hese should be recorded for all fish otolithed. If moderate- or heavily-feeding fish are found, olume of stomach contents should be measured (by displacement in a 500 c.c. measuring der) for about 10 fish per haul. A representative sample of stomach contents (10 per " area ") ld be preserved in 2 per cent formalin.

2. Hydrographic Instructions

tandard Depths

) Observations of temperature and salinity will be taken at the following standard depths, in es:

0, 10, 20, 30, 50, 75, 100, 150, 200, (250), 300, 400, 500, 600, (700), 800, and 1,000.

he depths in parentheses are optional, and will not be done unless requested by a member of Hydrographic Section.

In addition, an observation and sample will be taken as close to the bottom as possible whe sounding is less than 1,000 metres.

(*b*) Samples for nutrient salt analysis and dissolved oxygen content determination will be t at the following depths, in metres:

0, 20, 50, 100, 200, 300, 400, 600, 800, and 1,000.

In addition a sample will be taken as close to the bottom as possible when the sounding i than 1,000 metres.

(*c*) Bathythermograph lowerings should be made at all plankton and hydrographic sta (For procedure, see Admiralty Handbooks.) The ship should not be under way when the lowe are made.

(*d*) The surface thermograph should be run along all hydrographic sections.

(ii) Barents Sea Sections: Stations

(*a*) *Section I*

From Norway (Loppen) to Bear Island (Cape Bull).

Station	*Latitude N*	*Longitude E*
A	70° 46′	21° 14′
B	71° 06′	21° 04′
C	71° 25′	20° 54′
D	71° 55′	20° 35′
E	72° 24′	20° 18′
F	72° 54′	20° 01′
G	73° 19′	19° 46′
H	73° 28′	19° 40′
J	73° 38′	19° 33′
K	73° 43′	19° 30′
L	73° 53′	19° 24′
M	74° 08′	19° 14′
MX	74° 16′	19° 09′

(*b*) *Section II*

Westwards from Bear Island along the 74° 25′ N parallel. Stations at the following longi

Station	*Longitude E*
NX	18° 32′
N	18° 02′
P	17° 24′
Q	16° 46′
R	16° 27′
S	16° 08′
T	15° 49′
U	15° 30′
V	14° 15′
W	13° 00′

(*c*) Surface samples for salinity are to be taken by means of the Lumby Surface Sampler b Stations G and MX, and Stations NX and S. Samples should be taken every 10 minutes wh ship is steaming along these parts of the Sections.

(*d*) Soundings are to be taken every five miles along the sections. They are to be entere Sonic Depth Sheets provided.

(iii) Notes on Procedure at Oceanographic Stations

(*a*) The depths at which samples are to be collected should be planned before the sta begun. The meter wheel readings at which the bottles are to be attached and the depth to each hoist is to be lowered should be worked out. A blackboard is provided in the laborat this purpose.

b) When more than one series is used at a station, the series should be arranged so that the rmost bottle of the deeper series is at the same depth as the bottom bottle of the shallower s. This check may be dispensed with if sufficient bottles are not available, or if it would make ime spent at the station unduly long.

c) When a water bottle is removed from its rack for use, it is to be attached to the safety ess. This harness is to be removed only when the bottle is securely fixed to the hydrographic h wire. The safety harness is to be again secured to the bottle before the bottle is taken off the after use.

d) When a sample is being taken near the bottom, the lowest bottle of the series is to be ched to the wire seven metres above the weight on the end of the wire.

e) When each water bottle is attached to the wire it should be examined to ensure that the tap air vent are closed, and the thermometers should be inspected for any breaks of thread.

A series must not consist of more than five bottles unless it is calm, when six may be used. No e than two Munro bottles are to be used in any one series.

When the first bottle is attached to the wire, the meter wheel should be set to zero. When all the les have been attached to the wire and the series lowered so that the meter wheel reading equals depth required for the lowest bottle, the entire cast must be lowered by an amount equal to the ance between the sea surface and the height at which the bottles were put on (i.e., about 7 metres). s procedure corrects for the freeboard of the ship.

A similar procedure should be followed when using a frame to take bottom temperatures, pt that there is no need to make the adjustment for the amount of freeboard if the pen touches bottom. See Section iv (*f*).

f) After the bottles are lowered to the required depths, they are to be allowed to remain there five minutes, in order to settle down, before the messenger is dropped.

g) At depths of less than 200 metres the proper functioning of the bottles may be checked by ng the wire, as it is possible to feel the jerks when the messengers strike the bottles. When the ples are taken at great depths or when the wire angle is large, it is impossible to feel the jerks and cient time must be allowed for the messengers to reach the deepest bottle before hauling in. rate of travel of a messenger is approximately 200 metres per minute when the wire is vertical. reater wire angles the rate of travel is reduced.

h) Just before the messenger is released, the wire angle should be measured with the clinometer entered in the hydrographic log book.

i) When a bottle is brought into the laboratory, care should be taken to see that it is not turned the reversed position. Failure to do so may cause incorrect observations.

j) The two protected reversing thermometers on any one bottle should give main thermometer ings that differ by less than 0·1° C. All thermometers should be read by means of the magnifier ided. If the difference is greater than 0·1° C. the main thermometer readings should be cor- ed by means of the tables provided. If the values of T_w thus obtained differ by more than 0·04° C. observation should be repeated with a different bottle. The vertical distribution of temperature uld be examined before the ship leaves a station. If any of the temperatures are open to doubt, k observations should be made. This will show whether the bottle reversed prematurely or ther a thermometer is defective. If the discrepancy is due to the latter cause, the faulty ther- neter can be detected and watched when used again. If it gives three or four faulty readings to be changed. When the bottles have been secured in their racks after use, the main and liary thermometers must be allowed to settle down before they are read. The rate of change of uxiliary thermometer must be less than 1° C. per minute when the thermometers are read.

k) When making observations down to the bottom, it must be borne in mind that the lower- bottle may be some distance away from the bottom if the wire angle exceeds 20 deg. An amount of wire can be run out to enable the bottle to reach a position close to the bottom. amount of wire to be run out can be determined by observing the wire angle with the clinometer then using the Wire Angle Table. The meter wheel reading, when the extra wire has been run

out minus the amount of free board, is then entered in the log-book as the uppermost entry for t series in the column headed " Meter Wheel ".

(*l*) A messenger should not be attached to a water bottle until the bottle has been firmly secu to the hydrowire.

(*m*) To attach the bottles to the hydrowire when the wire angle is large, the hydrowire sho be pulled in with a Neptune's trident and then secured by means of a hook attached to the The wire must on no account be held with the trident while the bottles are put on the wire. Wh bottle has been attached, the strain should again be taken with the trident, the hook removed the wire eased out by means of the trident.

(*n*) The terminal weight on the hydrowire should be 100 lb.

(*o*) In bad weather large wire angles are usual. On deep stations, when two or more se have to be worked, such large angles may result in a large part of the water column not b sampled. For example, if the deepest series has a large wire angle, it will be necessary to let o large additional amount of wire to get the bottom bottle close to its required depth. This proce will place the top bottle of this series at a much greater depth than is required, and will result big gap in sampling between this bottle and the bottom one of the series above it. To avoid it is necessary to make a rough plot of bottle depths on a piece of graph paper at the end of station and before getting under way. The estimated depth of each bottle can be calculate multiplying the wire depth by the cosine of the wire angle. The Wire Angle Table or Tra Tables can be used for this purpose. When the estimated depth of each bottle has been plo the column should be examined for any large gaps between the series and, if necessary, an additi series should be worked in order to obtain samples close to the standard depths in these g Gaps of more than 200 metres when sampling depths between 300 and 1,000 metres unacceptable.

(*p*) Unprotected thermometers should be used on the bottom bottle at all stations where depth exceeds 150 metres.

At deep stations an unprotected thermometer should be used on the lowest bottle of all s that go to a depth greater than 150 metres.

Two or more unprotected thermometers should be used on all series that go to a depth gr than 600 metres. One should be on the lowest bottle and one on the highest; another shou used on an intermediate bottle, if possible.

(*q*) The following procedure is to be adopted when reading thermometers:

(i) One observer is to read all the left-hand thermometers

(ii) Another observer is to read all the right-hand thermometers

(iii) The two sets of readings are then to be compared, and, if any differences are found temperatures are to be read again. Then, if necessary, action is to be taken in accord with Section iii (*j*).

(iv) Unprotected thermometers are to be read by two observers in turn. To see if an u tected thermometer reading is of correct magnitude, it should be compared with the tected thermometer readings. The difference should equal nearly 1° C. for every 100 m depth.

(*r*) The clips on the top of the water bottle racks must be closed between stations.

(*s*) The temperature of the Hydrographic Laboratory is not to exceed 25° C. if damage t bathythermographs is to be prevented.

(iv) **Hydrographic Log Books (Deep Sea)**

(*a*) In the column headed " Meter Wheel ", the reading of the meter wheel when each is attached is entered. To do this for each series it is necessary to start at the number of lines the sheet equal to one more than the number of bottles used on the series, and then to work up The uppermost entry is the reading of the meter wheel when the bottom bottle has been lowe

required depth, and before the adjustment for the amount of free board has been made. The e depths in the next column can then be calculated. These depths are not corrected for wire le.

(*b*) A small correction ($\triangle$TW) has to be applied to the reading of the main thermometer (T) order to obtain the true temperature at reversal (T_w). This correction is obtained with the slide e and tables provided.

(*c*) In the columns under the heading " TIME," the time of starting a series (START) should be ered, together with the time when all the bottles have been lowered to the required depth (STOP), time of releasing the messenger (MESS.) and the time of starting to haul up (UP).

(*d*) Columns are provided for entering the numbers of the sample bottles used. Salinity sample tle numbers are entered under S $^{\circ}/_{\circ\circ}$; phosphate—P sample bottle numbers under PO_4, and so on. e dissolved oxygen samples must be drawn off first, followed by the salinity samples.

It is preferable to take the samples so that the bottles are in numerical order, with the lowest nber containing the sample from the surface and the highest number containing the sample from bottom or deepest depth sampled.

The salinity sample bottle numbers, together with details of depth, time, date, etc., must be ered on the analysis forms for the Government Chemist before the end of the cruise. These ms should be sent by post to the Government Chemist, Dudley House, Endell Street, London, C.2, on arrival in Grimbsy.

(*e*) The temperatures given by the main thermometers should be read to two decimal places and tten in the log book as three figures. Thus, a temperature of 2·80° should not be written as 2·8°. ain, 0·67° is correct and ·67° is incorrect. The temperatures given by the auxiliary thermometer uld be read to one decimal place and recorded as two figures.

(*f*) The small Hydrographic Log Book should be used for TF work. Temperatures should be entered in the Naturalist's Log Book. The depth entered in the log book should be the depth he frame not the pen. This will be the meter wheel reading, minus nine metres if the procedure l down in Sections iii (*e*) and vi is followed.

Stowage of Thermometers

(*a*) Two reversing thermometers should always be used with each water bottle. The thermo- er tubes must be packed at each end with sorbo washers and the thermometers must fit tightly he tubes. Unless a thermometer is giving incorrect readings, there should be no need to remove om its tube until the end of a cruise. The sorbo washers must be removed from the thermometer es at the end of each cruise.

(*b*) Spare thermometers should always be stowed vertically, in the non-reversed position, in boxes provided. Care must be taken to see that the mercury threads of these thermometers are broken.

(*c*) In rough weather and during long passages the thermometers must not be left in the reversed ition. They can be secured in the non-reversed position by reversing the water bottles in their ks.

(*d*) Reversing thermometers are sometimes capricious in operation. If a thermometer gives rrect readings it is to be changed and not used again during the cruise. The numbers of thermo- ers that are defective should be noted in the Hydrographic Log Book.

(*e*) The numbers of the thermometers on each bottle and frame are to be recorded on a Thermo- er Arrangement Sheet; a new sheet is to be completed whenever a thermometer is changed. sheets are to be returned to Lowestoft at the end of each cruise.

(*f*) Munro Water Bottles must not be allowed to reverse in air when the thermometers have n fitted in the tubes.

Taking Bottom Temperatures with an E and G Frame

A team of three is required: Naturalist, Winchman, and Spare Hand.

The Naturalist calls at the bridge; records the sounding in fathoms in the Hydrographic Book and switches on the loud hailer. He makes the conversion of the sounding into metres w he reaches the hydrographic laboratory aft and enters this conversion in the log book. In meantime the Winchman and Spare Hand switch on the Bridge Indicator Light; lower the until it is just below the surface of the water and put the wire in the hook on the rail, after ensu that the lead of the wire over the meter wheel is correct. They then set the meter wheel to zero see that all the lights aft and the loud-hailer are working.

Lowering

The Naturalist attaches the frame to the wire by first screwing up the clamp and then closing gate. He next inspects the thermometers to see that the mercury threads are not broken. M while the Spare Hand provides himself with a fending-off hook. When the Naturalist is sati that everything is in order he (the Naturalist) releases the wire from the hook and orders " LOV AWAY SLOWLY ". He then watches the frame down to the water and, if necessary, instructs Spare Hand to fend the wire away from the ship with his hook. When the frame has entered water the Naturalist orders " LOWER TO X METRES ", being 5 metres less than the d expected. He remains by the wire and watches the working of the gear for anything untowar

When the meter wheel reads 10 metres less than the ordered depth, the Naturalist o " SLOWLY " and he then tends the wire with the feeler until the bottom is felt, at Y metres He then orders " STOP LOWERING. HOIST TO (Y-2) METRES ". The Spare Hand s the stop-clock and the Naturalist enters the time and the depth of the *frame*, i.e., (Y-9) metres i log book. If the ship is drifting rapidly the bottom is felt for again every minute and new soun are obtained from the bridge and the log book amended if necessary. The Naturalist instruct Spare Hand when to send down the messenger. It should be released so that it reaches the f after the thermometers have been at the required depth for not less than 4 minutes. The S Hand feels the wire and informs the Naturalist when he feels the frame operate. The Natu should always use the stop-clock to time the descent of the messenger and should not giv order to hoist until he is certain that the messenger has had plenty of time to reach the frame. rate of descent is 200 metres per minute.

Hauling

The Naturalist now orders " HOIST AWAY " and the wire is hauled in rapidly, the S Hand guiding the wire on to the drum. The Naturalist watches the operation and sees tha gear is working correctly. When the meter wheel reads 20, the Naturalist orders " SLOW and returns to his position by the rail. The Spare Hand then stands by with the fending-off and uses it as instructed by the Naturalist. When the frame comes clear of the water, the Natu calls " COMING UP ", and when it is level with the taffrail he orders " HIGH ENOUGH which order the winchman stops hoisting and the Spare Hand puts the wire in the hook on th

The Naturalist now removes the messenger and hands it to the Spare Hand before unclan the frame. Having checked that the thermometers have worked, he orders " HOUSE THE P He secures the frame in the rack and reads and records the temperatures. If the Spare Han member of the scientific staff, he should do the recording and also check the readings. Whe Naturalist is satisfied that the temperatures have been correctly read and recorded, he revers frame, rejoins the mercury threads of the thermometers, and secures the frame in the rack i ready position.

When the station is finished and everything is secured the Naturalist informs the bridge " OF STATION " or " HYDROGRAPHIC WORK COMPLETED " and switches off the B Indicator Light.

(vii) **Observations for Monthly Synoptic Charts**

In order to provide data for the monthly synoptic charts, the thermograph is to be ru surface salinity samples are to be taken between Grimsby (or Aberdeen) and latitude 63 d both when outward and homeward bound.

Surface salinity samples are to be taken daily at 0600, 1200, 1800 and 2400 hours G.M.T details of the stations are to be entered in the small Hydrographic Log Book in the usual v

The surface sampler is now permanently rigged in the engine room and the procedure for ng it is as follows: The Officer of the Watch warns the engine room 15 minutes before a sample is uired. The engine room personnel place a bottle in the sampler and tell the O.O.W. its number. ey place the rubber tube in the neck of the bottle and turn on the water. At the appropriate e the O.O.W. tells them to take the sample. They remove the bottle, clip the stopper in place l turn off the water.

A Government Chemist Salinity Analysis form should be kept alongside the log in the chart-m. The O.O.W. is responsible for entering the serial number of the bottle, and the date, time l depth on this form. He is also responsible for seeing that the samples are taken in the correct nerical order. The N.I.C. enters the station number.

The positions where the samples are taken should be recorded on the Captain's Station Sheets. ese positions should normally be sufficient to allow the ship's track to be re-constructed for use n the thermograms, but the times and positions of any alterations of course and speed, should o be recorded on the Thermograph Position Log Sheets.

i) **Thermograph**

cedure:

(*a*) Open valve.

(*b*) Lower thermograph arm to extent of distance piece.

(*c*) The key to the recorder is on the port bulkhead in the main laboratory. The forms are in a in the racks on the forward bulkhead in the main laboratory.

(*d*) Unlock recorder. Remove top of drum and strap from side of the drum. Wind up clock uns for 8 days).

(*e*) Push pen arms from drum with lever provided. Ink the pens. Inks are in the recorder. per pen is purple, and lower red.

(*f*) Fit thermograph form and secure with strap. See that it fits tightly and that it is correctly ded-down all the way round.

(*g*) Fit top of drum. Allow pens to move to a position close to the drum. Turn drum by hand hat pens are at the correct time G.M.T. Let pens gently touch the drum. The lower pen should ouching the bottom line of the thermograph form and the pens should be recording identical es.

(*h*) The record must be changed at 0900 hours G.M.T. each day. Each record should bear the es of the 2 days on which it has been running. The thermograph must be synchronized with the elhouse clock at 0900 daily.

(*i*) The positions at which the thermograph is started and stopped should be recorded, together n the ship's position, every 4 hours and sufficient navigational data to allow the temperature t to be accurately extracted from the records. Forms for this purpose are stowed in the "Thermo-ph Record" box in main laboratory.

j) The thermograph arm should be hoisted on entering harbour and on approaching ice. 3. The arm must be pulled at an angle to get it up.) The valve must be closed when in harbour.

k) When a record is taken from the recorder, but not replaced with a blank, make sure that the s are touching the drum before closing the lid, otherwise the pens may get trapped.

l) Thermograms should be dried with clean blotting paper used with care.

m) The thermograph should be calibrated on each cruise at various temperatures throughout temperature range experienced during the cruise by taking reversing frame observations at metres depth.

The Winkler Method for the Analysis of Dissolved Oxygen in Sea Water

ed on U.S. Hydrographic Office Research Vessel Practice.)

Sampling

In obtaining the sample of sea water, great care must be taken to avoid bubbles of air. water must be transferred to the 270 ml. glass-stoppered bottle through a rubber tube exten from the nipple of the Nansen bottle to the bottom of the sample bottle. The sample bottle sh be filled slowly until it overflows, then the glass stopper should be replaced carefully in such a that no bubbles are entrapped.

Addition of Reagents

Immediately after obtaining the sample, introduce the following reagents well down ir bottle:

1. 1 ml. of $MnCl_2$ solution.
2. 1 ml. of NaOH-KI solution.

Shake thoroughly, and allow the precipitate to settle for 24 hours, then add:

3. 2 ml. of concentrated HCl.

Shake thoroughly until the precipitate dissolves. This is the " treated sample " and is now read titration. It must be kept in its drawer away from light until titrated.

Titration

1. Accurately pipette out 100 ml. of the treated sample, and transfer to a 250 ml. Erlenr flask.

2. Titrate with standardized $Na_2S_2O_3$ solution (approx. 0·005N) until the yellow colou almost disappeared. Add 4–6 drops of concentrated starch solution, which will produce a p or deep blue colour. Continue titration in easy stages until the solution is just colourless, agit the liquid continuously, without splashing, throughout the titration. The titration shou reproducible within 1·05 ml. When in doubt, run in duplicate. Should the end point be m discard the poor run and repeat the titration.

3. Record the burette readings immediately on Oxygen Working Sheet.

PROCEDURE FOR MAKING BLANK RUN IN THE OXYGEN DETERMINATION

This is the first step toward making the determination of the normality of the $Na_2S_2O_3$ (sc thiosulphate) solution. This blank run *must* be made each time a new batch of potassium i (KI) is made up. By doing this, we obtain the correction for the minute amount of diss oxygen in the KI reagent, and also any oxidizing effects of impurities in the hydrochloric reagent. Each batch should be re-checked from time to time, and the value entered on the O Working Sheet.

In detail, this is the procedure:

1. Accurately pipette out 100 ml. of freshly boiled distilled water. Transfer to a 250 ml. l meyer flask.

2. Add 5 ml. of 15 per cent KI solution.

3. Add 2 ml. concentrated HCl solution.

4. Titrate with sodium thiosulphate solution until the yellow colour has almost disapp (this may take only a drop or two).

5. Add 5 drops of concentrated aqueous starch solution and continue titration until the so is just colourless.

6. Record the burette readings on the Oxygen Working Sheet.

7. The amount of sodium thiosulphate used in the titration is the value V_b.

Now the standardization procedure may be followed, and the determination of the normality of the sodium thiosulphate solution can be accomplished.

STANDARDIZATION OF THE SODIUM THIOSULPHATE SOLUTION

1. Accurately pipette out 15 ml. of KHI_2O_6 standard of 0·005N, using a Knudsen p Transfer to a 250 ml. Erlenmeyer flask. Add 100 ml. *freshly boiled* distilled water.

2. Add 5 ml. of 15 per cent KI reagent.

3. Add 2 ml. of concentrated HCl solution.

4. Titrate $Na_2S_2O_3$ solution until the yellow colour has almost disappeared.

5. Add 5 drops of starch solution and titrate until the solution is just colourless. This titration uld be reproducible within $\pm$ 0·05 ml. Run duplicates and average best runs.

6. Record the burette readings on the Oxygen Working Sheet.

7. Calculate the normality of the sodium thiosulphate solution by means of the following ıula:

$$N = \frac{V_1 \times N_1}{V_2 - V_b}$$

Where:

N_1 = Normality of KHI_2O_6 solution (0·0050).
V_1 = ml. of KHI_2O_6 solution (15·0).
V_2 = ml. of $Na_2S_2O_3$ solution.
V_b = ml. correction from the blank run (is always positive).

TO DETERMINE THE OXYGEN CONTENT OF THE SEA WATER

$$\text{gen (ml./l.)} = N \times V \times \frac{B}{B\text{-}2} \times 5{\cdot}6 \times 10.$$

ere: N = normality of the sodium thiosulphate solution.
V = ml. of sodium thiosulphate used in titration.
B = volume of sample bottle (270 ml.).

refore, $O_2 = 56{\cdot}4\ NV.$

REAGENTS FOR OXYGEN DETERMINATION

$Cl_2 . 4H_2O$	400 gm./l.
)H-KI	180 gm. NaOH + 75 gm. KI per 500 ml. H_2O
... ...	Concentrated (12N) sp. gr. abt. 1·19.
... ...	15 per cent by weight (15 gm. KI in 100 ml. H_2O).
S_2O_3	3·723 gm. $Na_2S_2O_3 . 5H_2O$ in 3 litres distilled water.
I_2O_6	0·1625 gm. in 1 litre distilled water.
ch	Add 20 per cent KOH with stirring to 2 gm. starch in 300–400 ml. water until thick, syrupy, almost clear solution is obtained (i.e., about 30 ml. alkali). Stand for 1 hr. Make neutral or slightly acid with conc. HCl using litmus. Add 1 ml. glacial acetic acid.

Ice in the Barents Sea

)r. Helge Thomsen of the Danish Meteorological Institute requires information about ice in Barents Sea, so that it can be incorporated in the annual publication " The State of the Ice in Arctic Seas ".

The Master is therefore requested to complete one copy of the Ice Report Form and one copy ıe Barents Sea Ice Chart after cruises of the ERNEST HOLT during which ice is sighted. The ıs and charts should then be returned, in order that they may be forwarded to Copenhagen.

The blank forms and charts have been supplied by the Danish Meteorological Institute and be kept in the Ice Report File in the ship's main laboratory.

3. Instructions for Benthos Collection, 1951

The cod-end cover should be examined after each trawl haul, and its contents preserved in ıalin—the complete catch if possible. If the benthos catch is large, as much as possible should reserved.

All Crustacea (except *Lithodes maia*) should be preserved, especially " shrimps ".

All Echinoderms (except *Hippasterias*—the large pimply starfish) should be brought back to the ratory.

The quantity of Duffs in each haul should be noted, and to which of the three following t they belong:

Type A—white with smooth dermis.
Type B—rough with yellow-green dermis.
Type C—regular, pudding shape.

Small samples of other species may be preserved.

The trawl should be examined for Pycnogonids, and samples preserved. The large or *Colossendeis proboscidea* should be recorded, but need not always be preserved. Specimer other species cannot be identified with certainty on the ship.

The presence of *Alcyonidium* should be recorded, with a note of its abundance.

The Agassiz trawl should be used whenever convenient, and its catch preserved comple possible.

Large specimens preserved in the bin should be numbered with the waxed labels provided the number noted in the log book.

N.B. If there is any doubt whatever about the identification of species, the specimens shou preserved.

4. Collection of Otoliths

In order to economize in staff time and otolith envelopes, would Naturalist in charge of c please see that otoliths are cleaned of blood, etc., and dried in a soft duster before they ar away in the envelopes.

APPENDIX VII

PRESS NOTICES

Early in 1950 a short report on the first year's work of the ERNEST HOLT was published i *Times*. Later, the short general press release, reproduced in full below (1), was issued. Afte second year's work it was thought that a fuller report would be of interest to fishermen an general public. In March 1951, therefore, the report (2, below) was released to the Press.

1. **Use of Thermometers in Fishing for Cod on Bear Island Fishing Grounds** (*Released March* 14,

The Ministry of Agriculture and Fisheries research vessel ERNEST HOLT has been engage over a year investigating the best water temperatures on the bed of the sea for fishing cod on Island grounds.

The use of thermometers in fishing operations is promising, but there are many complica and it is not possible yet to say how to get the best results. In the meanwhile, the work ERNEST HOLT shows clearly that Bear Island cod is not, as a rule, found in large quantities in appreciably colder than 2° C. There is an important exception to this rule: during the seas heavy feeding from July to September, the cod towards Sea Horse Island (Hope Island) frequently taken in very large quantities in water colder than 0° C. It seems as if, when ac pursuing food such as the capelin, the cod is not as sensitive to cold water as it is at other

2. **Cod Catching at Bear Island** (*March* 8, 1951)

LIMITED USEFULNESS OF THERMOMETERS

(*From the first two years' research of the* ERNEST HOLT, *the Ministry of Agriculture and Fis reports both favourable and unfavourable results from trying to use thermometers to find fis certain times and places the thermometer was a good guide.*)

Before the work began, there was some information from the Newfoundland area. A ten ture of 2° to 4° C.* was considered favourable for cod fishing. Also, Norwegian and French

* A Centigrade degree is equal to 1·8 Fahrenheit degrees. Fresh water freezes at 0° Centigrade, or 32° Fah Sea water freezes at about minus 2° Centigrade.

n had sometimes used thermometers quite extensively. But, although there are " fishermen's " ersing thermometers listed in the instrument-makers' catalogues, there was not much information how useful they could be to a fisherman—and nothing particularly about the Bear Island area.

A PROMISING AREA

The Bear Island area looked promising for the use of thermometers. It is a place where warm ter, warmer than 4° C., meets cold water, of less than 2° C. The warm water is brought by the st Spitsbergen Current, which travels northwards along the western edge of Bear Island Bank. e cold water is on the shelf, having come from the north-east. The boundary between warm and d water may, at times, be very sharp; the ERNEST HOLT has passed from water of $5\frac{3}{4}$° C., on the face, to water of minus $\frac{1}{2}$° C., in a distance of three cables. The fishing grounds are on the undary between the two waters. This certainly seemed to be an area where a thermometer might a help in finding fish.

COD USUALLY AVOID COLD WATER

The usual run of cod at Bear Island are called " Bear Island sprag " or " large codling " or Mediums "; but in this article they will be called " cod ".

It was found that there was a difference in behaviour according to whether or not the cod were ding heavily. Most of the big bags taken at Bear Island are of fish not feeding heavily. Through- the work of the ERNEST HOLT, these fish only gave good catches—40 baskets ($1\frac{1}{2}$ tons) per hour more—when the bottom temperature was above $1\frac{3}{4}$° C. If the ERNEST HOLT found bottom tem- atures of less than $1\frac{3}{4}$° C., when she was seeking good bags, she would try deeper water, which uld usually be warmer.

In November 1949, there was some very good fishing south of the island, in water just above C. on the sea-bed. The best fishing—from 50 to 300 baskets per hour—lay within a few miles ıth of the edge of the $1\frac{3}{4}$° C. water. There was another peculiarity about this area, namely that vas under a " roof " of colder water—from $\frac{1}{4}$° to 2° C. cooler than the bottom water. It was as he cod, avoiding the colder water above, gathered near the sea-bed. This effect seemed to persist ıth of the island up till the following January; but similar water structure did not give good fishing ɔther seasons or on other grounds. In November 1950, both the special water arrangement and best fishing occurred at a shallower depth than in 1949, but neither the water structure nor the ing was very marked.

HEAVILY-FEEDING COD WENT INTO COLD WATER

On one of the early cruises of the ERNEST HOLT, great catches of cod were taken from very cold er, 0° to minus $\frac{1}{2}$° C. This was on grounds towards Sea Horse Island in July and August. The were feeding heavily on the Arctic fish, the capelin; and on krill, or " pink shrimp " as it is ıetimes called. It was concluded that these cod, east of Bear Island, were not affected by very l water, provided they were hungry enough. There seems, as yet, to be no use for a thermometer his particular fishery.

In general in high summer—July, August and September—the ERNEST HOLT has found no use a thermometer as a fishing aid, except perhaps for haddock on the Bear Island Bank. This use ds further investigation; but haddock are known to like slightly warmer water than cod.

COD FROM THE WEST SPITSBERGEN CURRENT

On the western grounds, from west of Cape Bull to the North-West Gully, there were some pro- ing results, again for cod that were not feeding heavily. In this area the West Spitsbergen rent and offshoots of it often touch the Bear Island Bank, and bring water of over 4° C. to the bed where they touch. In three months of the year, there has been better fishing where the warm ent struck the bank than anywhere else west of the island. These months were the same in h years, namely, at the end of May and beginning of June, in October, and in November. The areas were found by searching for bottom water of over $3\frac{3}{4}$° C. and then following the edge of it. six occasions, over the two years, the better fishing lay close to this edge, rather than away

from it. The good fishing was not always exactly in the $3\frac{3}{4}°$ C. water, but it was always within a miles of the $3\frac{3}{4}°$ C. line. It seems that it is not so much the temperature that counts, but rather West Spitsbergen Current.

MIGRATION THEORIES AND HYDROGRAPHY

It has to be remembered that the results of the ERNEST HOLT's work are only based on a ra short period mainly spent in the Bear Island area, and later work may alter them or add to th Experienced fishermen will be able to recall many other conditions that affect the cod, bes temperature. When the fish are up in the water, the trawl will not take them. The ERNEST H has " seen " fish on the echo-sounder in mid-water in the summer, and these were believed to cod. They too were in water of over $3\frac{1}{2}°$ C., but that water was off the bottom. And cod have l found feeding on herring, which would often be off the bottom at night, leading the cod away f where the trawl could get them—but they might descend again in daylight. The echo-sounde the ERNEST HOLT has shown this night and day migration of herring, up and down.

And behind the whole story there is a pattern of migration with the seasons, on which presence or absence of fish at Bear Island probably depends. The thermometer was of little u February and March, when there were offshoots of the West Spitsbergen Current on the Island Bank, but there seemed to be no great quantity of fish about. However, when fish are a in quantity, local hydrographic features can cause them to gather up into the great " mobs " give good bags—as in May–June, October, and November, west and north-west of the isla when the thermometer was a good guide.

APPENDIX VIII

STATION LIST FOR 1949 AND 1950

The following list gives the positions of all stations worked during 1949 and 1950, and deta the gear used at each station. In addition, catches of cod and bottom temperatures are given. C relevant information, such as damage to gear and catches of commercial fish other than co given in the footnotes.

From Cruise VII 1950 onwards, positions marked * were obtained either by direct astrono observation or from bearings of landmarks.

All times are given in Greenwich Mean Time.

Positions, times and depths of both shooting and hauling the trawl are given. Times of sho and hauling refer respectively to the time at which the warps are pulled into the towing-bloc the time of " knocking-out." Figures for catches of cod, and other species where noted, re the total catch as measured in 6-stone baskets.

All hydrographic data will be found in the *Bulletins Hydrographiques* 1949 and 1950, publishe the International Council for the Exploration of the Sea.

List of abbreviations used for gear:

Plankton Nets:

H. = Hensen net
F. = International fine silk net
1m.St. = 1 metre stramin tow-net
2m.St. = 2 metre stramin tow-net
2m. Shp. = 2 metre shrimp-netting tow-net

Fishing Nets, etc.:

T. = Standard trawl
C.1. = Cod-end cover (shrimp-nettin
A. = Agassiz trawl

Hydrographic Gear:

H.S. = Hydrographic series
R.F. = Reversing frame
S.S. = Surface sampler
B.T. = Bathythermograph
W/B. = Water bottle

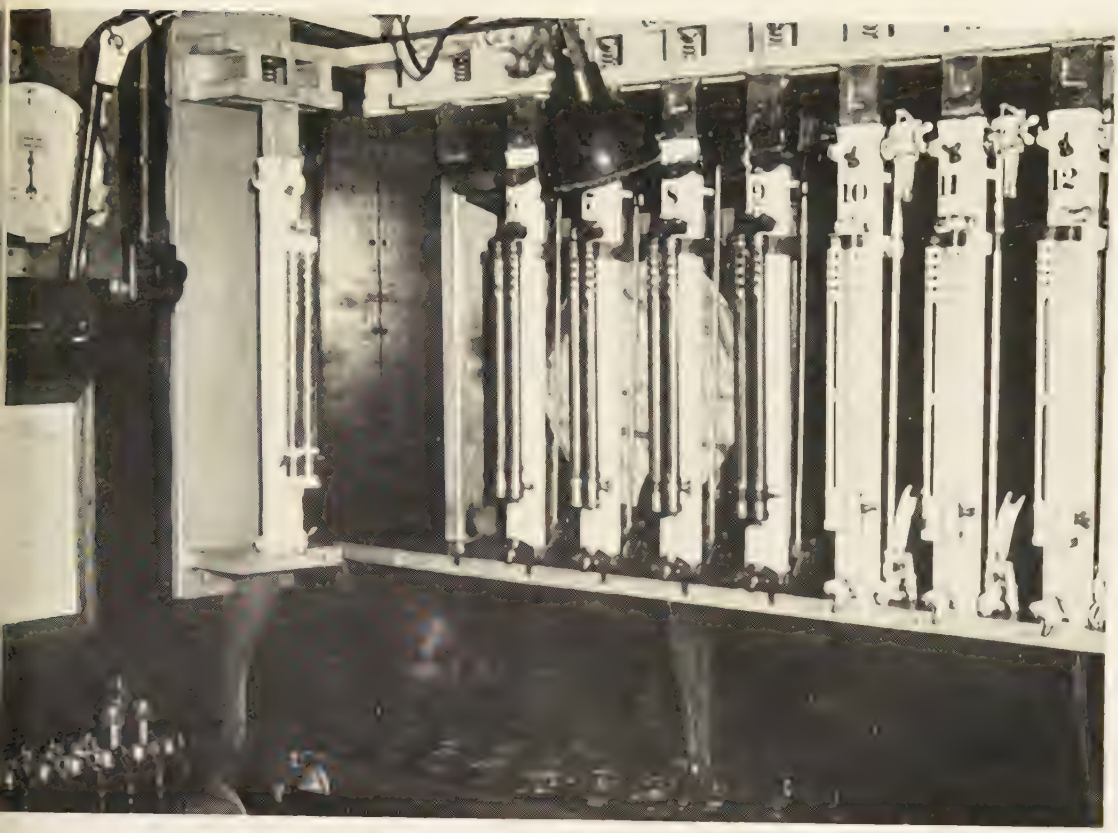
(Additional notes on some of the gear are given in Appendices II, IV, and V.)

The R.V. Ernest Holt, May 1952.

PLATE I

The launching of the R.V. ERNEST HOLT.

PLATE II



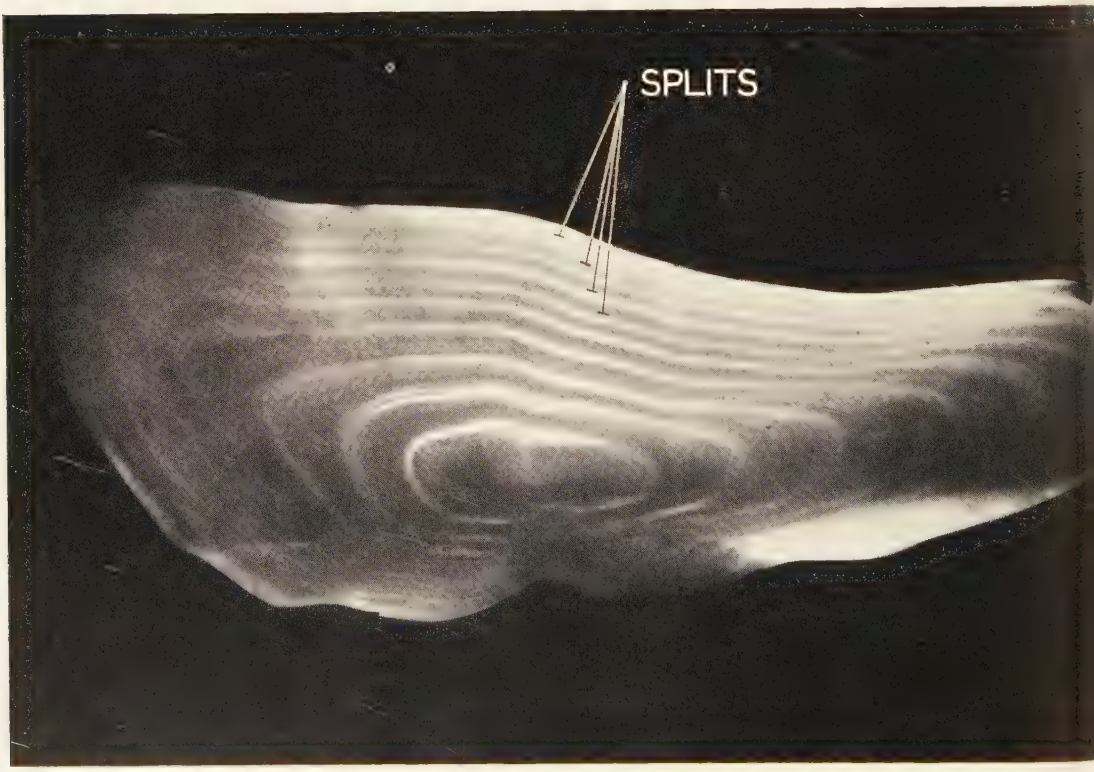
The Hydrographic Laboratory: Nansen water-bottle rack.

Interior of the wheelhouse showing the radar apparatus.

PLATE III

Photo : Kodak Research Labor

Transverse section of cod otolith (" Western " or " Svalbard " type) showing the ring structure.



Transverse section of cod otolith (" Western " Split-ring type) showing the ring structure.

CRUISE I. 1949

ion	Date 1949	Time G.M.T.	Latitude N °	′	Longitude E °	′	Sounding (Fathoms)	Gear	Bottom Temp. °C.	Catch (Baskets) Cod
	7-1	1451–1909	63	20	10	20 W	1,000+	H.S. (1)		
2a	16-1	0730	72	00	26	20 E	138	H.S. (2)		
		1030					137	Shot T.		
2		1130	72	01	26	30	140	Hauled T. (3)		14
		1250					140	R.F.	4·28	
		1350					140	Shot T.		
3		1510	72	02	26	40	142	Hauled T. (4)		9
		1615					142	R.F.	4·41	
		1710					142	Shot T.		
4		1810	72	03	26	48	138	Hauled T. (5)		12
		1910					138	R.F.	3·85	
		2200					138	Shot T.		
5		2300	72	05	26	58	132	Hauled T.		11
		2305					132	R.F.	3·65	
5	17-1	1000	72	07	27	12	128	R.F.	4·15	
		1050					122	Shot T.		
7		1150	72	11	27	17	121	Hauled T. (6)		9
		1235					121	R.F.	4·03	
8a		1340	72	12	27	18	120	Shot T.		
8		1500	72	15	27	28	130	Hauled T. (7)		8
		1555					130	R.F.	4·23	
		1720					130	Shot T.		
9		1915	72	16	27	00	130	Hauled T. (8)		20
		2005					130	R.F.	4·15	
		2110					128	Shot T.		
0		2310	72	14	26	38	136	Hauled T. (9)		4
	18-1	0017					135	R.F.	4·13	
		0100					140	Shot T.		
1		0300	72	11	26	15	130	Hauled T. (10)		
2	19-1	0945	70	50	17	12	157	R.F.	6·98	
		1100					145	Shot T.		
3		1300	70	50	17	40	125	Hauled T.		4
		1420					127	R.F.	6·91	
		1530					120	Shot T.		
4		1715	70	48	17	52	115	Hauled T.		4
		1830					114	R.F.	6·70	
5	20-1	1530	69	03	13	59	112	R.F.	7·12	
		1600					110	Shot T.		
6		1730	69	07	14	12	60	Hauled T. (11)		8
		1825					79	R.F.	7·11	
		1900					50	Shot T.		
7		2100	69	04	13	59	85	Hauled T. (12)		15
		2155					104	R.F.	7·26	
		2300					230	Shot T.		
8	21-1	0100	68	59	13	46	140	Hauled T. (13)		12
		0150					160	R.F.	7·25	
		0300					240	Shot T.		
9		0500	68	55	13	33	90	Hauled T.		29
		0500					115	R.F.	7·46	

No temp. taken close to bottom.
H.S., wire parted. 5 bottles lost.
6 baskets haddock.
5 baskets haddock.
6 baskets haddock.
5 baskets haddock.
Hauling faulty.

(8) 25 baskets haddock. 12 baskets redfish.
(9) 9 baskets haddock.
(10) Cod line parted. Total estimated catch 50 baskets.
(11) 7 baskets coalfish.
(12) Depth of tow varied: 50—150—85 fthms.
(13) Split belly and after bridle stranded.

CRUISE II. 1949

Station No.	Date 1949	Time G.M.T.	Latitude N		Longitude E		Sounding (Fathoms)	Gear	Bottom Temp. °C.	Cat (Bask Co
			°	′	°	′				
	19-2	0930	69	45	17	30	Various	Echo sounder		
	20-2	2030	70	10	17	10		Handlines		
	21-2	1425	68	28	11	30	197	R.F.	7·14	
		1515					180	Shot T.		
2a		1700	68	28½	11	46	150	Hauled T. (1)		16
3	22-2	0820	68	54	13	24	160	R.F.	7·36	
		0900					135	Shot T.		
3a		1100	68	50	13	15	160	Hauled T. (2)		
4		1925	68	34	12	00	205	R.F. (3)		
		2000					205	Shot T.		
4a		2200	68	39	12	08	140	Hauled T. (4)		17
5	23-2	0920–0940	68	32	12	00	186	R.F. (5)		
		1000					184	Shot T.		
5a		1130	68	30	11	52	180	Hauled T. (6)		3
6		1240	68	31	11	55	186	R.F.	7·45	
		1300					184	Shot T.		
6a		1500	68	29	11	47	190	Hauled T. (7)		3
7		1550	68	30	11	50	176	R.F.	7·38	
		1600					180	Shot T.		
8		1750	68	30	12	07	180	Hauled T.		5
		1825					96	R.F.	7·19	
		1930					77	Shot T.		
9		2130	68	36	12	19	70	Hauled T. (8)		9
		2220					104	R.F.	6·94	
		2245					98	Shot T.		
10	24-2	0015	68	34	12	11	80	Hauled T. (9)		8
		0045					74	R.F.	6·95	
11		0807	68	25	11	18	166	R.F.	7·15	
		0842						Echo sounder (10)		
12		1259	67	51	12	34	63	R.F.	6·52	
13		1525	67	58	12	11	105	R.F.	6·94	
14		1810	68	05	11	49	92	R.F.	7·01	
15		1930	68	11	11	28	90	R.F.	7·07	
16		2025	68	18	11	05	110	R.F.	7·00	
17	25-2	0610	68	27	11	33	210	R.F.	7·46	
		0715					210	Shot T.		
17a		0915	68	28	11	52	120	Hauled T. (11)		10
18		1038	68	29	11	54	152	R.F.	7·09	
		1115					150	Shot T.		
18a		1315	68	36	12	06	180	Hauled T. (12)		
19		1415	68	36	12	11	156	R.F.	7·01	
		1500					150	Shot T.		
19a		1700	68	40	12	30	140	Hauled T. (13)		20
20		1740	68	42	12	35	135	R.F.	7·09	
		1815					100	Shot T.		
20a		2015	68	46	12	52	68	Hauled T. (14)		1
21		2050	68	46	12	42	68	R.F.	6·84	
22	26-2	0900–1025	68	30	11	46	288	H.S. (15)	7·49	
23		1200–1453	68	35	11	15	682	H.S. (16)		

(1) 50 baskets haddock. 15 baskets coalfish.
(2) Belly ripped end to end. 5 baskets total. Depth of haul varied: 135—180—160 fthms.
(3) Reversing frame failed to operate.
(4) Headrope and footrope parted on hauling. Square and belly split.
(5) 2 attempts to take temp. negative. Messengers fouling gate mechanism.
(6) 6 baskets haddock.
(7) Depth of haul varied: 184—290—190 fthms. 15 baskets redfish. Warps not adjusted for change in depth.
(8) Depth of haul varied: 77—70—110—70 fthr
(9) Split belly. Forward quarter rope carried av
(10) Abandoned after 20 mins. Traces valu 3 valve amplifier fitted (stbd.). Better trac
(11) Split belly. 80 baskets redfish lost. Dep haul varied: 210—120—325—120 fthms.
(12) 120 baskets total catch (estimated).
(13) 5 baskets haddock. Depth of haul va 150—180—140 fthms.
(14) Depth of haul varied: 100—160—70—68 fth
(15) Temps. only.
(16) Temps. only. No temp. taken close to bott

CRUISE III. 1949

tion o.	Date 1949	Time G.M.T.	Latitude N		Longitude E		Sounding (Fathoms)	Gear	Bottom Temp. °C.	Catch (Baskets) Cod
			°	′	°	′				
1	20-3	2100–2118	74	25	13	00	1,000 +	2-H., F. (1)		
		2127–2330						H.S. (2)		
2	21-3	0230–0409	74	25	14	15	1,000 +	H.S.,2-H.,F.(2)		
3		0623–0646	74	25	15	30	600 +	2-H., F. (3)		
4		1230–1313	74	25	18	02	68	H.S.,2-H.,F.	1·00	
5		1434–1502	74	25	17	24	90	H.S.,2-H.,F.	2·11	
6		1632–1653	74	25	16	46	125	H.S.	2·05	
7		1732–1809	74	25	16	27	175	H.S.,2-H.,F.	1·91	
8		1911–2030	74	25	16	08	558	H.S. (2)		
9a	22-3	0115	74	14	17	26	100	Shot T.		
9		0215	74	12	17	30	105	Hauled T.		4
		0320					100	Shot T.		
0		0420	74	10	17	38	107	Hauled T.		8
		0530					105	Shot T.		
1		0630	74	07	17	44	105	Hauled T.		1
2		0937–1004	74	08	19	14	48	H.S.,2-H.,F.	− 0·41	
3		1150–1224	73	53	19	24	127	H.S.,2-H.,F.	1·08	
4		1337–1412	73	43	19	30	184	H.S.,2-H.,F.(2)		
5		1552–1621	73	38	19	33	228	H.S. (2)		
6		1756–1831	73	28	19	40	260	H.S.,2-H.,F.	2·30	
7		1947–2037	73	19	19	46	254	H.S.,2-H.,F.	1·63	
8	22/23-3	2332–0011	72	54	20	01	230	H.S.,2-H.,F.	3·72	
9	23-3	0355–0434	72	24	20	18	180	H.S.,2-H.,F.	3·86	
0		0800–0833	71	55	20	35	180	H.S.,2-H.,F.	4·71	
1		1140–1218	71	25	20	54	150	H.S.,2-H.,F.	4·90	
2	24-3	1904–2000	71	06	21	04	102	H.S.,3-H.,F.	5·84	
3		2150–2223	70	46	21	14	132	H.S.,3-H.,F.(2)		
4	30-3	1430–1450	63	23	04	35		F., 1m.St. (4)		

All H.F. vertical hauls 50 m. to surface.
No temp. taken close to bottom.

(3) Weather prevented hydrographic work.
(4) 1m.St. plus closing device lost.

CRUISE IV. 1949

Station No.	Date 1949	Time G.M.T.	Latitude N		Longitude E		Sounding (Fathoms)	Gear	Bottom Temp. °C.	Catc (Baske Coa
			°	′	°	′				
1a	26-4	1405	73	52	16	05	212	R.F.	1·30	
		1450					224	Shot T.		
1		1550	73	51	16	16	212	Hauled T. (1)		
		1615					214	R.F.	1·71	
		1720					210	Shot T.		
2		1825	73	47½	16	48	210	Hauled T. (2)		10
		1915					216	R.F.	2·01	
		2015					210	Shot T.		
3		2130	73	45	17	05	210	Hauled T.		25
		2220					210	R.F.	1·94	
		2310					210	Shot T.		
4	27-4	0010	73	42½	17	22	208	Hauled T.		30
		0105					210	R.F.	2·30	
5a		1900	73	42½	17	22	210	R.F.	2·18	
		2020					210	Shot T.		
5		2120	73	38	17	32	215	Hauled T.		25
		2200					215	R.F.	2·11	
		2252					210	Shot T.		
6		2359	73	35	17	42	212	Hauled T.		40
	28-4	0040					212	R.F.	2·59	
		0120					210	Shot T.		
7		0240	73	32	17	52	210	Hauled T.		40
		0320					210	R.F.	2·36	
		0430					206	Shot T.		
8		0530	73	30½	18	06	212	Hauled T.		25
		0615					212	R.F.	2·43	
		0720					220	Shot T.		
9		0825	73	31½	18	21	216	Hauled T.		5
		0905					216	R.F.	2·19	
		0940					215	Shot T.		
10		1040	73	31	18	38	210	Hauled T.		2
		1115					215	R.F.	1·25	
		1205					205	Shot T.		
11		1310	73	32½	18	46	206	Hauled T.		2
		1335					212	R.F.	1·26	
12a	29-4	0120	74	09½	18	28	64	R.F.	0·74	
		0220					60	Shot T.		
12		0320	74	07	18	22	65	Hauled T.		
		0345					67	R.F.	1·18	
13a		0915	74	03	18	07	74	Shot T.		
13		1015	74	00	17	56	95	Hauled T.		
		1045					95	R.F.	0·47	
		1120					110	Shot T.		
14		1220	73	57½	17	50	112	Hauled T.		
		1300					112	R.F.	1·56	
		1330					110	Shot T.		
15		1430	73	53	17	48	126	Hauled T.		
		1500					128	R.F.	1·61	
		1530					135	Shot T.		
16		1630	73	48½	17	43	150	Hauled T.		
		1655					150	R.F.	1·69	
		1730					155	Shot T.		
17		1830	73	44	17	34	190	Hauled T.		
		1910					190	R.F.		
		1945					191	Shot T.		
18		2045	73	42	17	32	204	Hauled T.		1
		2125					204	R.F.	2·62	
19a	30-4	0440	73	42	17	32	200	R.F.	2·79	
		0520					200	Shot T.		
19		0630	73	39	17	24	215	Hauled T.		1

CRUISE IV. 1949—(*contd.*)

tion o.	Date 1949	Time G.M.T.	Latitude N		Longitude E		Sounding (Fathoms)	Gear	Bottom Temp. °C.	Catch (Baskets) Cod
			°	′	°	′				
9	30-4	0700	73	39	17	24	215	R.F.	2·49	
		0745					214	Shot T.		
0		0845	73	37½	17	16	220	Hauled T.		70
		0930					220	R.F.	2·66	
1a		1000	73	37½	17	24	224	Shot T.		
1		1100	73	35	17	06	228	Hauled T.		15
		1135					228	R.F.	2·54	
		1230					230	Shot T.		
2		1330	73	33	17	00	233	Hauled T.		20
		1400					233	R.F.	2·53	
3a		1450	73	30½	16	46	233	Shot T.		
3		1550	73	28	16	34	240	Hauled T.		20
		1625					240	R.F.	2·57	
4a		1915	73	20½	16	10	259	Shot T.		
4		2015	73	16	16	08	264	Hauled T.		
		2050					265	R.F.	2·75	
5a	1-5	0418	73	01	16	38	248	R.F.	4·28	
		0500					248	Shot T.		
5		0600	72	56	16	50	240	Hauled T.		1
		0640					240	R.F.	4·03	
6a		0827	72	43	17	36	210	R.F.	5·04	
		0910					210	Shot T.		
6		1010	72	38	17	45	205	Hauled T. (3)		1
		1030					205	R.F.	3·77	
7a	2-5	0431	72	47	18	12	220	R.F.	1·88	
		0510					220	Shot T.		
7		0615	72	50	18	13	230	Hauled T.		1
		0700					230	R.F.	2·91	
8a		0903	73	05	18	21	240	R.F.	2·12	
		0945					240	Shot T.		
8		1045	73	11	18	15	244	Hauled T.		3
		1127					245	R.F.	1·99	
9a		1352	73	26½	18	02	228	R.F.	1·96	
		1430					228	Shot T.		
9		1530	73	28	17	45	226	Hauled T.		2
		1610					226	R.F.	2·81	
0a		1750	73	33	17	12	230	R.F.	2·18	
		1845					230	Shot T.		
0		1945	73	35	16	59	230	Hauled T.		8
		2042					230	R.F.	2·80	
		2130					230	Shot T.		
1		2230	73	37	16	47	228	Hauled T.		5
		2321					228	R.F.	3·42	
2a	3-5	0704	73	37	16	59	228	R.F.	2·65	
		0750					228	Shot T.		
2		0845	73	40	16	50	222	Hauled T.		15
		0936					222	R.F.	2·87	
		1005					226	Shot T.		
3		1105	73	40	16	38	228	Hauled T.		20
		1105					228	R.F.	2·40	
4a		1220	73	40	16	50	226	Shot T.		
4		1320	73	43	16	50	222	Hauled T.		7
		1400					222	R.F.	2·60	
		1450					224	Shot T.		
5		1550	73	47	16	50	212	Hauled T.		6
		1625					212	R.F.	2·02	
		1720					218	Shot T.		
6		1820	73	50	16	38	205	Hauled T.		8
		1935					205	R.F.	2·03	
		2010					210	Shot T.		

CRUISE IV. 1949—(*contd.*)

Station No.	*Date 1949*	*Time G.M.T.*	*Latitude N*		*Longitude E*		*Sounding (Fathoms)*	*Gear*	*Bottom Temp. °C.*	*Cat (Bask Co*
			°	′	°	′				
37	3-5	2110	73	51	16	22	218	Hauled T. (5)		4
		2146					218	R.F.	2·09	
		2230					216	Shot T.		
38		2330	73	52	16	13	215	Hauled T.		15
		2359					215	R.F.	2·10	
39a	4-5	0715	74	50	17	30	160	R.F.	0·48	
		0815					160	Shot T.		
39		0915	74	50	17	44	177	Hauled T.		7
		0945					177	R.F.	0·52	
		1040					175	Shot T.		
40		1145	74	50	17	58	166	Hauled T.		
		1222					166	R.F.	0·83	
		1315					165	Shot T.		
41		1413	74	50	18	14	130	Hauled T.		2
		1445					130	R.F.	1·11	
42		1525	74	50	18	06	157	R.F.	0·79	
43	5-5	2130	72	03	25	04	148	R.F.	4·54	
44		2230	72	05½	25	18	144	R.F.	3·90	
45		2316	72	08	25	32	144	R.F.	3·50	
46	6-5	0010	72	10½	25	46	140	R.F.	3·34	
47		0107	72	13	26	00	136	R.F.	3·74	
48		0200	72	15½	26	14	139	R.F.	3·36	
49		0309	72	18	26	28	140	R.F.	3·37	
50		0443	72	11	25	40	149	R.F.	4·08	
51		0556	72	03	25	40	140	R.F.	3·93	
52a		0723	72	02	25	08	150	R.F.	4·59	
		0815					150	Shot T.		
52		0915	72	05	25	16	148	Hauled T.		1
		0940					148	R.F.	4·41	
		1040					148	Shot T.		
53		1140	72	08	25	24	150	Hauled T.		
		1210					150	R.F.	4·15	
		1315					149	Shot T.		
54		1415	72	11	25	33	150	Hauled T.		2
55a	7-5	1015	72	38	26	30	155	Shot T.		
55		1215	72	34	26	10	154	Hauled T.		
		1320					152	Shot T.		
56		1520	72	28	26	19	150	Hauled T.		
		1615					149	Shot T.		
57		1815	72	22	26	10	140	Hauled T.		3
		1910					140	Shot T.		
58		2110	72	16	25	55	142	Hauled T.		6
		2200					142	Shot T.		
59	8-5	0030	72	10	25	40	135	Hauled T.		4
60a		0720	72	10	25	50	134	Shot T.		
60		0920	72	15	26	05	140	Hauled T.		3
61		0955–1100	72	15	26	05	140	T. (4)		

(1) Trawl not fishing properly.
(2) Split in cod-end. Numbers of cod seen escaping. 20 baskets estimated.
(3) 280 baskets of redfish.
(4) Came fast. Warp parted. Trawl badly dam
(5) Cod-end out.

CRUISE V. 1949

Date 1949	Time G.M.T.	Latitude N		Longitude E		Sounding (Fathoms)	Gear		Bottom Temp. °C.	Catch (Baskets) Cod
		°	′	°	′					
31-5	1650–1723	74	00	15	00	901	1m.St.			
	1936–2007	74	14	15	52	522	1m.St., S.s.			
	2142–2215	74	34	16	16	266	1m.St., S.s.			
1-6	0210	75	00	17	42	69	R.F.		1·32	
	0303	74	55	17	42	104	R.F.		1·59	
	0355	74	50	17	42	178	R.F.		0·95	
	0455	74	44	17	42	96	R.F.		3·25	
	0545	74	39	17	42	58	R.F.		2·06	
	0855	74	33	16	25	162	Shot T.			
	0955	74	28	16	25	170	Hauled T.	(1)		60
	1045					190	R.F.		4·06	
	1205	74	28	16	45	108	R.F.		3·27	
	1240					110	Shot T.			
	1340	74	21	16	45	110	Hauled T.			250
	1500					110	R.F.		3·13	
	1552	74	20	16	30	140	R.F.		4·51	
	1655	74	15	16	30	160	R.F.		2·14	
	1745	74	10	16	33	165	R.F.		1·88	
	1840	74	07	16	40	160	R.F.		2·77	
	2010	74	07	17	30	116	R.F.		1·97	
	2105	74	12	17	25	108	R.F.		1·70	
	2148	74	18	17	15	102	R.F.		1·73	
2-6	0705	74	13	17	15	110	R.F.		2·02	
	0750					110	Shot T.			
	0850	74	08	17	17	110	Hauled T.			270
	1000					110	R.F.		1·75	
	1152	74	08	16	45	162	R.F.		3·68	
	1235					160	Shot T.			
	1335	74	00	16	45	160	Hauled T.			10
	1415					160	R.F.		2·92	
	1456–1530					160	1m.St.			
	1710–1745	74	13	17	17	110	1m.St.			
	1915	74	11	16	32	160	R.F.		3·51	
	1945					160	Shot T.			
	2045	74	15	16	29	155	Hauled T.			10
	2121					155	R.F.	(2)		
	2230	74	20	16	30	160	R.F.		2·49	
	2310	74	23	16	46	111	R.F.		2·63	
	2355	74	26	17	11	100	R.F.		1·82	
3-6	0630	74	25	17	11	100	R.F.		1·88	
	0710					98	Shot T.			
	0810	74	28	17	01	102	Hauled T.	(3)		200
	0907					100	R.F.		1·74	
	0953	74	32	16	52	100	R.F.		1·94	
	1030					100	Shot T.			
	1130	74	36	16	52	100	Hauled T.			60
	1207					100	R.F.		1·35	
	1240	74	35	16	41	120	R.F.		1·70	
	1315					115	Shot T.			
	1415	74	30	16	34	150	Hauled T.			1
	1450					150	R.F.		1·64	
	1535	74	29	16	25	190	R.F.		3·52	
	1600					170	Shot T.			
	1700	74	33	16	15	174	Hauled T.			1
	1745					174	R.F.		1·87	
	2050	74	40	16	45	110	R.F.		2·88	
	2205–2245					120	1m.St.			
4-6	0710	74	45	18	02	100	R.F.		3·25	
	0750					110	Shot T.			
	0850	74	44	17	45	110	Hauled T.			

CRUISE V. 1949—(*contd.*)

Station No.	Date 1949	Time G.M.T.	Latitude N		Longitude E		Sounding (Fathoms)	Gear	Bottom Temp. °C.	Cat (Bask Co
			°	′	°	′				
39	4-6	0930	74	44	17	45	110	R.F.	3·22	
		0945–1015					110	1m.St.		
40		1110	74	48	17	48	161	S.s.		
		1125					161	R.F.	1·48	
		1200					161	Shot T.		
41		1300	74	48	18	10	164	Hauled T.		
		1345					164	R.F.	1·52	
		1410					160	Shot T.		
42		1510	74	49	18	20	140	Hauled T.		
		1550					140	R.F.	1·92	
43		1630	74	53	18	22	90	R.F.	− 0·37	
		1645					90	S.s.		
		1700					90	Shot T.		
44		1800	74	49	18	40	90	Hauled T.		
		1840					90	R.F.	1·09	
		1905–1945					90	2m.St.		
45		2110–2155	74	45	18	02	120	2m.St.		
46	5-6	0730–0855	74	47	16	45	100	2—1m.St.		
47		1049–1123	74	47	15	35	420	1m.St., S.s.		
48		1254–1405	74	47	14	55	794	1m.St.		
49		1513–1640	74	47	14	20	1030	2—1m.St., S.s.		
50		1805–2117	74	47	13	30	1158–1205	4—1m.St., S.s.		
51	6-6	0708	74	47	16	45	127	Shot T.		
		0738					90	Hauled T.		10
		0845					90	R.F.	4·98	
52		0928	74	47	16	45	94	R.F.	3·55	
		0952					94	R.F., Echo sounder (4)		
		1025					100	Shot T.		
53		1100	74	47	16	45	92	Hauled T.		1
		1140					92	R.F.	2·67	
		1245					95	Shot T.		
54		1315	74	47	16	45	100	Hauled T.		10
		1400					100	R.F.	2·08	
		1410					100	R.F.	1·82	
55		1653	74	52	17	24	90	R.F.	1·80	
		1720					110	Shot T.		
56		1820	74	54	17	12	110	Hauled T. (5)		
		1855					104	R.F.	1·36	
		1920					100	Shot T.		
57		2020	74	58	17	05	110	Hauled T.		
		2040					110	R.F.	2·52	
58	7-6	0513–0526	74	08	19	14	59	2-H., F.		
59		0707–0718	73	53	19	24	120	2-H., F.		
60		0829–0840	73	43	19	30	200	2-H., F.		
61	10-6	1419–1430	70	46	21	14	112	2-H., F.		
62		1635–1653	71	06	21	04	98	2-H., F.		
63		1845–1941	71	25	20	54	160	2-H., F., 1m.St.		
64		2221–2324	71	55	20	35	193	2-H., F., 1m.St.		
65	11-6	0220–0235	72	24	20	18	185	2-H., F.		
66		0535–0550	72	54	20	01	230	2-H., F.		
67		0815–0825	73	19	19	46	254	2-H., F.		
68		0947–0958	73	28	19	40	260	2-H., F.		
69		1300	73	52	19	40	122	R.F.	1·49	
		1330					129	Shot T.		
70		1430	73	54	19	26	130	Hauled T.		
		1504					129	R.F.	1·35	
71		1600	73	54	19	30	99	R.F.	1·92	
		1605					105	Shot T.		
72		1705	73	54	19	15	97	Hauled T.		
		1720					97	R.F.	1·72	
73		1845	73	55	18	44	104	R.F.	1·68	

CRUISE V. 1949—(*contd.*)

on	Date 1949	Time G.M.T.	Latitude N		Longitude E		Sounding (Fathoms)	Gear	Bottom Temp. °C.	Catch (Baskets) Cod
			°	′	°	′				
	11-6	1915	73	55	18	44	106	Shot T.		
		2015					102	Hauled T.		
		2045	73	55	18	25	102	R.F.		
		2115					110	Shot T.	1·59	
		2215					105	Hauled T.		
			73	56	18	04				25
		2250					105	R.F.	1·47	
	12-6	0642–0928	73	56	18	04	110	3—1m.St. (6)		
		1000					110	R.F.	1·65	
		1030					120	Shot T.		
		1130	73	58	17	52	110	Hauled T., Headline net		15
		1200					110	R.F.	1·83	
		1300					110	Shot T.		
		1400	74	01	17	43	115	Hauled T., Headline net (7)		20
		1430					115	R.F.	1·89	
		1510						F.		
		1535					115	Shot T.		
		1635	74	04	17	41	119	Hauled T. (8)		10
		1700					119	R.F.	1·86	
		1810					115	Shot T.		
		1910	74	07	17	38	114	Hauled T.		2
		1935					114	R.F.	1·90	
		2010					116	Shot T.		
		2110	74	09	17	20	116	Hauled T.		
		2205					116	R.F.	4·53	
		2300	74	11	17	08	119	R.F., Echo sounder	2·85	
	13-6	0650	74	07	17	15	120	R.F.	3·89	
		0720					120	Shot T.		
		0820	74	09	17	09	125	Hauled T.		300
		0920					125	R.F.	3·51	
		1320	74	09	16	50	147	R.F.	2·82	
		1335					147	R.F. (4)		
		1400					153	Shot T.		
		1500	74	05	16	50	150	Hauled T. (7)		120
		1550					153	R.F.	2·84	
		1630					143	Shot T.		
		1730	74	01	16	50	145	Hauled T.		30
		1810					143	R.F.	2·65	
		1825					143	R.F. (4)		
		1935	73	58	17	17	135	R.F.	2·21	
		2000					130	Shot T.		
		2100	74	02	17	10	135	Hauled T.		40
		2155					135	R.F.	2·66	
	14-6	0720	74	11	17	50	104	R.F.	1·97	
		0825					105	Shot T.		
		0925	74	11	17	40	108	Hauled T.		
		1000					105	R.F.	2·36	
		1540	74	19	17	00	120	R.F.	3·20	
		1630					120	Shot T.		
		1730	74	23	16	48	135	Hauled T.		80
		1815					134	R.F.	3·32	
		1845					134	R.F. (4)		
		1920					134	Shot T.		
		2020	74	20	16	45	134	Hauled T.		80
		2100					136	R.F.	4·23	
	15-6	0600	74	31	16	26	170	Echo sounder		
		0750	74	32	16	44	101	Echo sounder		
		0804	74	32	16	44	101	R.F.	4·86	
		0815					101	R.F., Echo sounder (4)		
		0900	74	31½	16	33	118	R.F.	2·23	
		0915					118	R.F., Echo sounder (4)		

CRUISE V. 1949—(*contd.*)

Station No.	*Date 1949*	*Time G.M.T.*	*Latitude N*		*Longitude E*		*Sounding (Fathoms)*	*Gear*	*Bottom Temp. °C.*	*Cat (Bask Co*
			°	′	°	′				
98	15-6	1000	74	31	16	19	170	R.F.	4·10	
		1015					170	R.F., Echo sounder (4)		
99a		1120	74	31	16	30	130	Shot T.		
99		1210	74	34½	16	29	130	Hauled T. (9)		325
		1330					145	R.F. (4)		
		1345					145	R.F.	2·23	
100		1500	74	29	16	25	150	R.F., Echo sounder (4)		
		1510					150	R.F.	3·71	
101		1630	74	26	16	35	145	R.F.	3·91	
		1645					145	R.F., Echo sounder (4)		
102		1845	74	37½	16	23	142	R.F.	2·73	
		1900					142	R.F., Echo sounder (4)		
103		2000	74	37½	16	33	108	R.F., Echo sounder	4·89	
104	16-6	0858–0935	74	39½	16	30	126	H.S., Echo sounder (10)	2·60	
		1000					126	S.s. (11)		
105		1106–1135	74	35	16	36	122	H.S., Echo sounder (10), (2)		
106		1230–1328	74	29	16	36	138	H.S., Echo sounder (10)	4·19	

(1) Depth of haul varied: 162—136—170 fthms.
(2) No temp. taken close to bottom.
(3) 5 baskets haddock.
(4) Temp. taken in mid water in connection with echo search in addition to bottom temp.
(5) Depth of haul varied: 110—80—110 fthms.
(6) 3rd haul, net badly torn.
(7) Small hole in cod-end.
(8) Hole in lengthening piece of cod-end.
(9) Depth of haul varied: 130—160—130 fthms
(10) H.S. taken in connection with echo search.
(11) Thread broke on thermometer of surface sa

CRUISE VI. 1949

Date 1949	Time G.M.T.	Latitude N		Longitude E		Sounding (Fathoms)	Gear	Bottom Temp. °C.	Catch (Baskets) Cod
		°	′	°	′				
12-7	0047–0237	74	25	13	00	1188	H.S.,2-H.,F.(1)		
	0445–0600	74	25	14	15	1070	H.S.,2-H.,F.(1)		
	0801–0930	74	25	15	30	782	H.S.,2-H., F(1)		
	1040–1127	74	25	16	08	494	H.S. (1)		
	1250–1340	74	25	16	27	170	H.S., 2-H., F.	3·84	
	1434–1457	74	25	16	46	113	H.S.	3·32	
	1550–1630	74	25	17	24	94	H.S., 2-H., F.	2·90	
	1730–1830	74	25	18	02	66	H.S., 2-H., F.	2·47	
13-7	0735	74	08	20	51	92	R.F.	1·60	
	0805					90	Shot T.		
	0905	74	07½	20	38	67	Hauled T.		50
	1024					66	R.F.	1·98	
	1045					70	Shot T.		
	1215	74	12	20	18	60	Hauled T.		50
	1245					60	R.F.	1·65	
	1330					64	Shot T.		
	1500	74	18	20	11	78	Hauled T. (2)		50
	1627					78	R.F.	1·69	
	1730	74	20	20	13	70	Shot T.		
	1830					70	Hauled T.		25
	1901					70	R.F.	1·64	
	1950					66	Shot T.		
	2050	74	23	20	10	62	Hauled T. (3)		5
	2112					64	R.F.	1·11	
	2305	74	22½	19	55	53	R.F.	0·21	
14-7	0755	74	21½	19	57	60	R.F.	0·23	
	0830					56	Shot T.		
	0930	74	22	20	06	64	Hauled T.		2
	1000					64	R.F.	0·44	
	1035					60	Shot T.		
	1135	74	24	20	08	57	Hauled T.		5
	1202					57	R.F.	0·75	
	1403	74	11	20	16	65	R.F.	1·52	
	1445					63	Shot T.		
	1545	74	08	20	06	60	Hauled T.		10
	1611					56	R.F.	1·62	
	1700					58	Shot T.		
	1800	74	05	19	59	65	Hauled T. (4)		40
	1820					67	R.F.	1·96	
	1910					70	Shot T.		
	2010	74	01	19	49	72	Hauled T. (5)		120
	2035					72	R.F.	1·79	
15-7	0825–0930	74	05	20	04	90	1m.St. (6)		
	1245–1300	73	59	19	32	82	H.S.	2·03	
	1310–1625	74	04½	19	18	64	3—2m.St.		
	1811	74	08	19	14	44	2-H., F.		
	1831					44	H.S.	1·06	
	2005–2043	73	53	19	24	108	H.S., 2-H., F.	1·12	
	2147–2218	73	43	19	30	184	H.S., 2-H., F.	0·97	
	2315–2337	73	38	19	33	240	H.S.	1·17	
16-7	0045–0128	73	28	19	40	258	H.S., 2-H., F.	1·16	
	0301–0336	73	19	19	46	254	H.S., 2-H., F.	1·30	
	0620–0655	72	54	20	01	230	H.S., 2-H.	1·65	
	0948–1021	72	24	20	18	178	H.S., 2-H.	3·82	
	1309–1354	71	55	20	35	178	H.S., 2-H. (1)		
	1647–1718	71	22	20	38	138	H.S., 2-H., F.	5·28	
	1929–1957	71	04	20	46	100	H.S., 2-H., F.	5·74	
	2131–2156	70	46	21	14	120	H.S., 2-H., F.	5·76	
19-7	1050–1123	70	46	21	14	116	H.S. (7)		
	1327–1350	71	06	21	04	100	H.S., 2-H., F.	5·92	

CRUISE VI. 1949—(*contd.*)

Station No.	*Date 1949*	*Time G.M.T.*	*Latitude N*		*Longitude E*		*Sounding (Fathoms)*	*Gear*	*Bottom Temp. °C.*	*Cat (Bake Co*
			°	′	°	′				
40	19-7	1607–1635	71	25	20	54	160	H.S., 2-H., F.	4·88	
41	20-7	0055–0108	72	54	20	01	231	H.S. **(8)**		
42		0335–0346	73	19	19	46	252	H.S. **(9)**		
43		0813	74	02½	19	26	64	R.F.	2·02	
		0900					65	Shot T.		
44		1000	74	01	19	12	66	Hauled T.		20
		1041					66	R.F.	2·00	
		1120					68	Shot T.		
45		1220	74	00	18	58	54	Hauled T. **(10)**		5(
		1250					54	R.F.	1·78	
		1320					58	Shot T.		
46		1420	74	00½	18	42	64	Hauled T. **(11)**		3(
		1454					64	R.F.	1·73	
47		1545	73	56	18	42	92	R.F.	1·84	
		1630					86	Shot T.		
48		1730	73	55½	18	58	98	Hauled T.		
		1759					98	R.F.	1·45	
		1840					94	Shot T.		
49		1940	73	55	19	12	80	Hauled T.		6(
		2008					80	R.F.	1·59	
		2040					80	Shot T.		
50		2140	73	53½	19	24	90	Hauled T.		
		2208					93	R.F.	1·43	
51	21-7	0655	74	22	18	10	70	R.F.	2·27	
		0740					70	Shot T.		
52		0840	74	24½	18	02	70	Hauled T.		
		0910					68	R.F.	2·34	
		0940					65	Shot T.		
53		1040	74	25	17	54	65	Hauled T.		1
		1106					65	R.F.	2·58	
		1215					65	Shot T.		
54		1315	74	24½	17	46	72	Hauled T.		
		1350					72	R.F.	2·71	
55		1410–1455	74	20	17	46	72	2m.St. **(12)**		
56	22-7	0856	74	27	23	18	92	R.F.	0·20	
		0930					96	Shot T.		
57		1030	74	30	23	22	82	Hauled T.		20(
		1124					81	R.F.	0·37	
		1230					90	Shot T.		
58		1330	74	33	23	34	94	Hauled T.		24
		1815					97	R.F.	− 0·05	
		1940–1957					97	H.S.	0·03	
59	23-7	0700	75	00	25	26	100	R.F.	0·04	
		0800					100	Shot T.		
60		0900	75	03	25	37	100	Hauled T.		
		0940					100	R.F.	− 0·32	
		1030					104	Shot T.		
61		1130	75	01	25	47	114	Hauled T.		
		1200					114	R.F.	0·06	
62		1423	75	03	24	51	85	H.S.	− 0·40	
		1510					90	Shot T.		
63		1610	75	03½	24	30	92	Hauled T.		4
		1642					92	R.F.	− 0·09	
		1730					95	Shot T.		
64		1830	75	05	24	10	90	Hauled T.		4
		1855					90	R.F.	− 0·59	
65		2007	75	00	23	45	70	R.F.	− 0·65	
		2040					75	Shot T.		
66		2140	75	05	23	45	72	Hauled T.		
		2223					70	H.S.	− 0·65	

CRUISE VI. 1949—(*contd.*)

on	Date 1949	Time G.M.T.	Latitude N		Longitude E		Sounding (Fathoms)	Gear	Bottom Temp. °C.	Catch (Baskets) Cod
			°	′	°	′				
	24-7	0652	75	19	26	16	95	R.F.	0·23	
		0800					98	Shot T.		
		0900	75	16	26	02	98	Hauled T.		15
		0944					98	H.S.	0·22	
		1030					98	Shot T.		
		1130	75	15	25	48	98	Hauled T. (13)		
		1205					106	R.F.	0·18	
		1330					106	Shot T.		
		1430	75	10	25	38	110	Hauled T. (13)		
		1505					104	R.F.	0·09	
	25-7	0732	74	43	23	00	55	H.S.	−0·48	
		1135–1154	74	21½	24	11	176	H.S.	1·04	
		1321–1341	74	14	24	36	235	H.S.	1·11	
		1831	74	20	22	11	92	R.F.	0·22	
		1915					85	Shot T.		
		2015	74	16	22	14	113	Hauled T.		25
		2047					107	R.F.	0·78	
		2130					110	Shot T.		
		2230	74	18	22	26	88	Hauled T.		120
		2306					88	R.F.	0·98	
	26-7	0721	74	57	17	56	89	R.F.	2·93	
		0815					72	Shot T.		
		0915	74	58	17	46	58	Hauled T. (14)		8
		0940					58	R.F.	2·91	
		1030					62	Shot T.		
		1130	75	00½	17	40	78	Hauled T. (15)		1
		1159					72	R.F.	3·06	
		1240					78	Shot T.		
		1340	75	03	17	40	75	Hauled T. (16)		2
		1420					75	R.F.	2·88	
		1520					74	Shot T.		
		1620	75	06	17	34	56	Hauled T. (17)		
		1647					56	R.F.	3·04	

Io temp. taken close to bottom.
oul trawl. Cod-end came up between ship's side and headline.
Vings of trawl ripped.
everal small holes in top of cod-end.
od-end holed badly on underside, 2 false bellies fitted.
let lost on 2nd haul.
amples for dissolved oxygen content only.
amples for phosphates only.

(9) Samples for oxygen only.
(10) 6 baskets haddock.
(11) Trawl slightly torn.
(12) Winch defective after hauling, centre drum flanges buckled.
(13) Cod-end out.
(14) 7 baskets haddock.
(15) Cod-end of trawl damaged.
(16) Cod-end badly ripped.
(17) Cod-end extensively damaged.

CRUISE VII. 1949

Station No.	Date 1949	Time G.M.T.	Latitude N		Longitude E		Sounding (Fathoms)	Gear	Bottom Temp. °C.	Ca (Bas C
			°	′	°	′				
1	3-9	0700	76	21	26	21	74	R.F.	0·02	
		0740					72	Shot T.		
2		0840	76	16	26	30	70	Hauled T. (1)	0·37	
		0930					74	R.F.		
		1030					72	Shot T.		
3		1130	76	12½	26	36	76	Hauled T. (2)	0·38	
		1208					76	R.F.		
		1230					82	Shot T.		
4		1330	76	09	26	42	86	Hauled T.	0·31	
		1405					86	R.F.		
		1430					90	Shot T.		
5		1530	76	06	26	48	94	Hauled T.	0·45	
		1608					94	R.F.		
6		1713–1800	76	06	26	48	94	1m.St.	0·64	
7		1915	76	09	27	03	110	R.F.		
		1945					112	Shot. T.		
8		2045	76	10	27	20	112	Hauled T.	0·63	
		2120					112	R.F.		
9	4-9	0640	76	21	28	52	120	R.F.	0·68	
		0720					116	Shot T.		
10		0820	76	24	29	00	117	Hauled T. (3)	0·73	
		0910					117	R.F.		
		0927–1105					117	2—1m.St.		
		1300					116	Shot T.		
11		1400	76	28	28	58	119	Hauled T.		
		1437					118	R.F.	0·74	
		1515					120	Shot T.		
12		1615	76	33	28	56	118	Hauled T.	0·59	
		1650					118	R.F.		
		1730					118	Shot T.		
13		1830	76	33	28	44	102	Hauled T.	0·52	
		1915					102	R.F.		
		1950					96	Shot T.		
14		2050	76	35	28	30	90	Hauled T.	0·68	
		2135					92	R.F.		
		2153–2235					93	2m.Shp.		
15	5-9	0648	76	42½	32	56	105	R.F.	0·89	
		0730					108	Shot T.		
16		0830	76	44	33	14	98	Hauled T.	0·63	
		0910					98	R.F.		
		0930					94	Shot T		
17		1030	76	48	33	22	77	Hauled T.	— 0·64	
		1105					80	R.F.		
		1215					84	Shot T.		
18		1315	76	51	33	14	100	Hauled T. (4)		
		1357					94	R.F.	0·02	
		1410–1505						1m.St.		
		1525						R.F.		
19		1734	76	51	32	00	135	R.F.	0·82	
		1815					134	Shot T.		
20		1915	76	48	32	13	132	Hauled T.	0·85	
		1945					132	R.F.		
		2015					130	Shot T.		
21		2115	76	45	32	29	130	Hauled T.	0·81	
		2150					128	R.F.		
22	6-9	0655	76	25	26	15	57	R.F.	— 1·15	
		0730					50	Shot T.		
23		0930	76	15	26	04	58	Hauled T. (5)		
		1010					58	R.F.	0·78	
		1026–1110						1m.St.		

CRUISE VII. 1949—(*contd.*)

tion o.	Date 1949	Time G.M.T.	Latitude N		Longitude E		Sounding (Fathoms)	Gear	Bottom Temp. °C.	Catch (Baskets) Cod
			°	′	°	′				
4	6-9	1330	76	06	26	32	84	R.F.	0·32	
		1410					90	Shot T.		
5		1540	75	58	26	50	98	Hauled T.		20
		1610					99	R.F.	0·60	
		1640					102	Shot T.		
6		1810	75	49	26	50	102	Hauled T.		30
		1850					103	R.F.	0·41	
		1915					105	Shot T.		
7		2045	75	40	26	50	97	Hauled T.		25
		2120					97	R.F.	0·38	
8	10-9	2150–2158	70	46	21	14	124	2-H.		
		2223–2240					124	H.S.	6·13	
9	11-9	0735–0740	71	06	21	04	102	2-H.		
		0750–0807					102	H.S.	6·58	
0		1030–1040	71	25	20	54	161	2-H., F.		
		1050–1108					161	H.S.	5·58	
1		1440–1450	71	55	20	35	188	F., 2-H.		
		1503–1526					188	H.S.	4·05	
2		1843–1852	72	24	20	18	179	2-H., F.		
		1859–1918					179	H.S.	4·82	
3		2235–2307	72	54	20	01	232	F., 2-H., H.S.	1·82	
4	12-9	0200–0300	73	19	19	46	249	2-H., F., H.S.	1·48	
5		0410–0447	73	28	19	40	262	F., 2-H., H.S.	1·18	
6		0620–0642	73	38	19	33	260	H.S.	1·51	
7		0756–0918	73	43	19	30	190	2-H., F., H.S.	1·33	
8		1023–1044	73	53	19	24	108	F., 2-H., H.S.	1·67	
9		1218–1236	74	08	19	14	44	2-H., H.S.	1·08	
		1400					46	Shot T.		
0		1540	74	04	19	02	46	Hauled T. (6)		
1	15-9	0932–0955	74	25	18	02	70	2-H., F., H.S.	2·00	
2		1110–1131	74	25	17	24	96	F., 2-H., H.S.	3·53	
3		1252–1312	74	25	16	46	110	H.S.	3·35	
4		1355–1442	74	25	16	27	138	2-H., F., H.S.	3·45	
5		1535–1638	74	25	16	08	496	H.S. (7)		
6		1759–1856	74	25	15	30	784	F., 2-H., H.S. (7)		
7		2108–2213	74	25	14	15	1130	2-H., F., H.S. (7)		
8	16-9	0025–0122	74	25	13	00	No bottom	F., 2-H., H.S. (7)		

Hole in cod-end. Extra hide put on.
Hole in bottom of cod-end and belly.
Square badly torn.
Few small holes in cod-end.

(5) Hole in cod-end. False bellies torn. Bunts torn.
(6) Came fast. Hauled. Parted footrope. Cod-end. After lower wing. Bunts badly damaged.
(7) No temp. taken close to bottom.

CRUISE VIII. 1949

Station No.	Date 1949	Time G.M.T.	Latitude N		Longitude E		Sounding (Fathoms)	Gear	Bottom Temp. °C.	Cat (Bask Co
			°	′	°	′				
1	11-10	1820	75	36	18	55	50	Shot T.		
		1835					51	R.F.	2·50	
2		2015	75	36	18	25	72	Hauled T. (1)		37
		2057					72	R.F.	3·38	
		2120					72	Shot T.		
3		2315	75	29	18	15	74	Hauled T. (2)		12
		2358					73	R.F.	3·43	
4	12-10	0727	75	29	18	26	72	R.F. (3)		
		0815					64	Shot T.		
5		1010	75	25	18	00	58	Hauled T. (4)		30
		1048					59	R.F.	3·33	
		1115					60	Shot T.		
6		1315	75	19	17	38	66	Hauled T.		
		1359					69	R.F.	3·65	
		1415					70	Shot T.		
7		1615	75	24	17	22	74	Hauled T. (5)		20
		1645					72	R.F.	3·56	
		1710					70	Shot T.		
8		1910	75	31	17	36	94	Hauled T. (6)		40
		1949					94	R.F.	3·43	
		2000					90	Shot T.		
9		2200	75	37	17	53	55	Hauled T. (7)		1
		2248					44	R.F.	3·27	
		2258–2328						1m.St.		
10	13-10	0705	75	58	18	53	54	R.F.	3·26	
		0730					55	Shot T.		
11		0930	75	55	18	33	40	Hauled T. (8)		
		0959					42	R.F.	2·65	
		1030					44	Shot T.		
12		1230	75	51	18	12	48	Hauled T.		
		1313–1343						1m.St.		
		1301					48	R.F.	3·21	
		1415					70	Shot T.		
13		1615	75	45	18	20	60	Hauled T. (9)		
		1654					60	R.F. (10)		
14	15-10	0839	74	58	17	00	90	R.F.	3·65	
		0930					110	Shot T.		
15		1130	74	52	17	10	155	Hauled T.		
		1225					152	R.F.	4·21	
		1245					148	Shot T.		
16		1445	74	42	17	10	85	Hauled T.		
		1527					87	R.F.	4·88	
		1645					90	Shot T.		
17		1835	74	39	17	04	90	R.F.	4·88	
		1845					90	Hauled T.		
		1915					88	Shot T.		
18		2015	74	37	17	19	82	Hauled T. (11)		1
		2057					82	R.F.	3·33	
		2125					82	Shot T.		
19		2225	74	35	17	33	74	Hauled T. (12)		1
		2308					72	R.F.	2·48	
20	16-10	0655	74	40	17	28	75	R.F.	5·00	
		0720					72	Shot T.		
21		0820	74	40	17	40	68	Hauled T. (13)		2
		0902					68	R.F.	3·65	
		0920					68	Shot T.		
22		1025	74	39	17	50	62	Hauled T. (14)		3
		1103					62	R.F.	2·74	
		1215					59	Shot T.		
23		1315	74	38	18	00	66	Hauled T. (15)		1

CRUISE VIII. 1949—(*contd.*)

Date 1949	Time G.M.T.	Latitude N		Longitude E		Sounding (Fathoms)	Gear	Bottom Temp. °C.	Catch (Baskets) Cod
		°	′	°	′				
16-10	1352	74	38	18	00	67	R.F.	4·56	
	1430					69	Shot T.		
	1530	74	37	18	16	70	Hauled T. (16)		
	1620					72	R.F.	2·20	
	2110	74	12	17	07	128	R.F.	2·00	
	2140					120	Shot T.		
	2240	74	13	17	23	110	Hauled T.		2
	2326					110	R.F.	2·58	
17-10	0015					110	1m.St.		
	0632	74	13	17	33	110	R.F.	2·21	
	0720					110	Shot T.		
	0820	74	13	17	47	98	Hauled T.		3
	0857					100	R.F.	2·84	
	0915					100	Shot T.		
	1015	74	14	18	02	79	Hauled T.		5
	1059					79	R.F.	2·13	
	1200					80	Shot T.		
	1400	74	22½	18	02	76	Hauled T. (17)		5
	1428					76	R.F.	2·21	
	1450					76	Shot T.		
	1650	74	27½	18	11	63	Hauled T. (18)		18
	1717					63	R.F.	1·91	
	1840					60	Shot T.		
	1950	74	31½	18	11	57	Hauled T. (19)		5
	2027					55	R.F.	1·37	
	2055					55	Shot T.		
	2255	74	32	17	44	64	Hauled T. (20)		10
	2324					67	R.F.	2·03	
18-10	0636	74	32	17	44	65	R.F.	1·97	
	0815					70	Shot T.		
	1007	74	38	17	26	80	R.F.	3·05	
	1015					81	Hauled T. (21)		5
	1115					70	Shot T.		
	1245	74	43	17	47	110	Hauled T. (22)		20
	1328					105	R.F.	4·90	
	1350–1420						1m.St.		
	1500					70	Shot T.		
	1600	74	40½	17	50	68	Hauled T. (23)		25
	1647					72	R.F.	2·63	
19-10	0815					90	Shot T.		
	0915					80	Hauled T. (24)		5
	1100					56	Shot T.		
	1300					68	Hauled T. (25)		
	1330					70	Shot T.		
	1530					56	Hauled T. (26)		
	1845					70	Shot T.		
	2045					70	Hauled T. (27)		
20-10	0630					68	Shot T.		
	0830					82	Hauled T. (28)		
	0900						Shot T.		
	1030					68	Hauled T. (29)		
	1145						Shot T.		
	1345					110	Hauled T. (30)		3
	1430					86	Shot T.		
	1630					70	Hauled T. (31)		
	1700					100	Shot T.		
	1900					90	Hauled T. (32)		
	1930					86	Shot T.		
	2130					100	Hauled T. (33)		
	2331	74	39½	17	28	75	R.F.	4·05	

Commercial Hauls in Area South of North-west Gully

CRUISE VIII. 1949—(*contd.*)

Station No.	*Date* 1949	*Time G.M.T.*	*Latitude N*		*Longitude E*		*Sounding (Fathoms)*	*Gear*	*Bottom Temp. °C.*	*Ca (Bas Co*
			°	′	°	′				
48	20-10	2333	74	39½	17	28	75	R.F.		
49	21-10	0031	74	42½	17	10	116	R.F.		
		0034					116	R.F.	4·14	
50		0132	74	44½	16	48	116	R.F.		
		0135					116	R.F.	4·18	
51		0214	74	39½	16	52	103	R.F.		
		0221					103	R.F.	3·81	
52		0304	74	37½	17	12	88	R.F.		
		0310					88	R.F.	3·99	
53		0403	74	35	17	33	80	R.F.		
		0404					80	R.F.	3·17	
54		0449	74	37½	17	49	66	R.F.		
		0451					66	R.F.	2·41	
55		0536	74	32½	17	53	66	R.F.		
		0538					66	R.F.	3·00	
56		0723	74	40½	17	59	59	R.F.		
		0724					59	R.F.	3·85	
57		0833	74	37½	18	24	80	R.F.		
		0837					80	R.F.	1·61	
58		0937	74	31½	18	20	47	R.F.		
		0940					47	R.F.	0·87	

(1) 48 baskets haddock.
(2) 18 baskets haddock.
(3) No temp. taken close to bottom.
(4) 40 baskets haddock.
(5) 50 baskets haddock.
(6) 40 baskets haddock.
(7) 15 baskets haddock.
(8) 5 baskets haddock.
(9) 5 baskets haddock.
(10) Frame reversed prematurely.
(11) After bunt out, 15 baskets haddock.
(12) 20 baskets haddock.
(13) 25 baskets haddock.
(14) 40 baskets haddock. Split slightly in fore bunt.
(15) 15 baskets haddock. 40 baskets coalfish.
(16) Cod-end out.
(17) Depth of haul varied: 80—110—76 fthms.
(18) 12 baskets haddock. Fore wing damaged.
(19) 5 baskets haddock.
(20) 10 baskets haddock.
(21) Bridle and after quarter rope parted. 5 1 catfish.
(22) 40 baskets haddock.
(23) 75 baskets haddock.
(24) After warp stranded. Total catch 25 1 mixed. Haul varied: 90—120—80 fthms
(25) Total catch 45 baskets mixed. Small hole end.
(26) Total catch 40 baskets mixed.
(27) Total catch 25 baskets mixed (mainly ha Fore and after bunts split.
(28) Total catch 15 baskets mixed.
(29) Wings damaged.
(30) 6 baskets haddock.
(31) Total catch 10 baskets mixed.
(32) 5 baskets haddock.
(33) 10 baskets mixed (mainly haddock).

CRUISE IX. 1949

tion o.	Date 1949	Time G.M.T.	Latitude N		Longitude E		Sounding (Fathoms)	Gear	Bottom Temp. °C.	Catch (Baskets) Cod
			°	′	°	′				
1	20-11	1758	73	55	19	05	89	R.F.	1·96	
2	21-11	0628	74	33	16	22	195	R.F.	4·06	
3		0722	74	32	16	40	120	R.F.	3·73	
4		0812	74	31	17	00	100	R.F.	3·72	
5		0901	74	30	17	10	92	R.F.	1·99	
6		0944	74	29	17	36	78	R.F.	1·72	
7		1358	74	33½	16	34	120	R.F.	3·89	
		1500					112	Shot T.		
8		1600	74	33	16	49	102	Hauled T.		5
		1630						R.F. (1)		
		1655					102	Shot T.		
9		1800	74	31	17	04	97	Hauled T.		5
		1816					97	R.F.	3·63	
		1850					96	Shot T.		
10		1950	74	28½	17	07	94	Hauled T. (2)		4
		2025					93	R.F.	2·23	
		2045					94	Shot T.		
11		2145	74	30	17	29	85	R.F.	1·75	
		2150					83	Hauled T.		5
		2245					86	Shot T.		
12		2345	74	32	17	38	85	Hauled T.		10
	22-11	0017					86	R.F. (3)		
13		0406	74	44	16	01	214	R.F.	3·67	
14		0527	74	44	15	42	463	R.F.	1·65	
15		0758	74	43½	16	44	110	R.F.	3·92	
		0830					110	Shot T.		
16		1030	74	36	16	40	115	Hauled T. (4)		25
		1055					120	R.F.	4·30	
		1120					120	Shot T.		
17		1320	74	28½	16	42	115	Hauled T. (5)		30
		1404					115	R.F.	4·58	
		1530					110	Shot T.		
18		1730	74	20	16	44	118	Hauled T		42
		1745					125	R.F.	4·46	
		1820					118	Shot T.		
19		2020	74	11	16	55	115	Hauled T. (6)		80
		2020					113	R.F.	3·15	
		2120					118	Shot T.		
20		2320	74	07	17	13	120	Hauled T. (7)		5
		2330					120	R.F.	2·98	
	23-11	0020					120	Shot T.		
21		0220	73	58	17	40	118	Hauled T. (8)		3
		0225					118	R.F.	3·01	
22		0504	73	58	17	01	151	R.F.	3·79	
		0515					151	R.F.		
23		0655	74	06½	17	28	112	R.F.	3·27	
24		0744	74	09½	17	38	104	R.F.	2·64	
25		0835	74	13	17	55	89	R.F.	2·26	
26		0916	74	17	18	03	88	R.F.	2·32	
27		1005	74	19½	18	12	72	R.F.	1·27	
		1055					72	Shot T.		
28		1145	74	17½	17	54	80	R.F.	2·30	
		1155					80	Hauled T.		50
		1255					80	Shot T.		
29		1355	74	21	17	42	81	Hauled T. (9)		55
		1355					80	R.F.	2·48	
		1515					86	Shot T.		
30		1615	74	18	17	34	92	Hauled T.		40
		1640					92	R.F.	3·49	
		1715					92	Shot T.		

CRUISE IX. 1949—(*contd.*)

Station No.	*Date 1949*	*Time G.M.T.*	*Latitude N*		*Longitude E*		*Sounding (Fathoms)*	*Gear*	*Bottom Temp. °C.*	*Catch (Basket Cod*
			°	′	°	′				
31	23–11	1815	74	13	17	19	103	Hauled T.		15
		1847					103	R.F.	3·92	
		1910					103	Shot T.		
32		2010	74	16	17	05	115	Hauled T.		5
		2110					115	R.F.	4·56	
		2110					115	Shot T.		
33		2210	74	16	16	48	125	Hauled T. **(10)**		2
		2210					125	R.F. **(3)**		
34	24-11	0133–0242	74	25	16	08	600	H.S. **(3)**		
35		0400–0421	74	25	16	27	154	H.S. **(3)**		
36		0526	74	25	16	46	108	H.S.	4·49	
37		0705	74	25	17	24	93	H.S.	2·80	
38		0823	74	25	18	02	68	H.S.	0·91	
39		0940	74	31	18	09	60	R.F.	0·38	
		1030					55	Shot T.		
40		1230	74	23½	18	09	60	Hauled T.		2
		1242					60	R.F.	0·44	
		1304					58	Shot T.		
41		1505	74	17	18	15	58	Hauled T.		4
		1543					60	R.F.	0·13	
		1610					55	Shot T.		
42		1810	74	11½	18	15	60	Hauled T. **(11)**		4
		1834					60	R.F.	1·61	
		1930					60	Shot T.		
43		2120	74	07	18	28	68	R.F.	1·60	
		2130					65	Hauled T.		1
		2200					68	Shot T.		
44		2400	74	01	18	37	70	Hauled T.		8
	25-11	0037					70	R.F.	1·82	
45		0756	74	04½	19	09	60	R.F.	0·93	
		0820					60	Shot T.		
46		0920	74	00½	19	09	70	Hauled T.		3
		0954					70	R.F.	1·86	
		1015					70	Shot T.		
47		1115	73	58	19	12	78	Hauled T.		3
		1141					78	R.F.	1·97	
		1230					76	Shot T.		
48		1330	73	55	19	16	102	Hauled T. **(12)**		
		1412					100	R.F.	2·11	
		1445					80	Shot T.		
49		1545	73	52	19	19	110	Hauled T. **(13)**		
		1620					110	R.F.	2·06	
		1720					110	Shot T.		
50		1820	73	48½	19	30	150	Hauled T. **(14)**		20
		2000					150	R.F.	1·93	
		2130					150	Shot T.		
51		2230	73	46½	19	40	170	Hauled T.		1
		2308					170	R.F.	2·18	
52	26-11	0134–0224	73	33	19	35	258	H.S. **(3)**		
53		0405–0448	73	43½	19	30	170	H.S. **(3)**		
54		0606–0626	73	52½	19	24	105	H.S.	1·98	
55		0827	74	07	19	14	47	H.S.	0·28	
56		0954	74	02	18	46	61	R.F.	1·95	
		1035					62	Shot T.		
57		1135	74	01	18	28	78	Hauled T.		3
		1203					78	R.F.	1·92	
		1240					78	Shot T.		
58		1340	73	59	18	13	90	Hauled T.		5
		1410					90	R.F.	2·15	
		1500					90	Shot T.		

CRUISE IX. 1949—(*contd.*)

Date 1949	Time G.M.T.	Latitude N		Longitude E		Sounding (Fathoms)	Gear	Bottom Temp. °C.	Catch (Baskets) Cod
		°	′	°	′				
26–11	1600	73	57	18	01	110	Hauled T.		140
	1648					110	R.F.	2·40	
	1700					90	Shot T.		
	1800	73	54	17	53	110	Hauled T.		150
	1935					114	R.F.	2·09	
	2015					117	Shot T.		
	2115	73	52	17	45	136	Hauled T.		80
	2147					136	R.F.	1·69	
	2215					136	Shot T.		
	2315	73	49	17	35	157	Hauled T. (**15**)		5
	2350					157	R.F.	1·80	
27-11	0734	73	57½	17	36	110	R.F.	2·01	
	0820					110	Shot T.		
	1010	73	56½	18	04	110	Hauled T. (**16**)		300
	1100					110	R.F.	1·82	
	1130					117	Shot T.		
	1330	73	52	18	38	115	Hauled T. (**17**)		500
	1420					117	R.F.	1·88	
	1530					117	Shot T.		
	1730	73	51½	19	06	115	Hauled T.		150
	1810					115	R.F.	1·99	
	1845					115	Shot T.		
	2045	73	51	19	30	115	Hauled T.		100
	2105					115	R.F.	1·97	
	2130					115	Shot T.		
	2330	73	53½	19	57	115	Hauled T. (**18**)		80
28-11	0132					115	R.F.	2·16	
	1415	73	59	20	22	118	R.F.	2·18	
	1455					118	Shot T.		
	1555	74	01	20	24	100	Hauled T. (**19**)		8
	1635					100	R.F.	2·28	
	1705					100	Shot T.		
	1805	74	04½	20	24	75	Hauled T. (**20**)		50
	1907					75	R.F.	2·01	

Thermometer failed to function.
baskets haddock.
No temp. taken close to bottom.
0 baskets haddock. 10 baskets redfish. Small hole in trawl.
baskets redfish. Damage around mouth of trawl.
baskets haddock.
0 baskets redfish.
Hole in cod-end.
Cod-end split when hauling inboard.
Small tears in belly.
After wing out.

(**12**) Belly split on hauling. Part of catch lost—estimated 80 baskets cod.
(**13**) Cod line meshes broke. Catch about 50 baskets, lost.
(**14**) Mending (sisal) of cod-end broke while hauling 6th bag.
(**15**) 5 baskets redfish.
(**16**) Only part of catch lifted.
(**17**) Split down belly. Most of catch lost.
(**18**) 80 baskets redfish. Only part of catch lifted.
(**19**) 5 baskets redfish.
(**20**) Warps fouled winding-on-gear. Cut to clear.

CRUISE I. 1950

Station No.	Date 1950	Time G.M.T.	Latitude N		Longitude E		Sounding (Fathoms)	Gear	Bottom Temp. °C.	Catc (Baske Coc
			°	′	°	′				
1	11-1	2130	74	43	15	52	196	R.F.	4·22	
2		2225	74	42	16	10	159	R.F.	4·78	
3		2325	74	41	16	28	120	R.F.	3·68	
4	12-1	0020	74	40	16	46	123	R.F.	3·42	
5		0130	74	38	17	00	98	R.F.	3·16	
6		0245	74	36	17	15	93	R.F.	2·62	
7		0345	74	35	17	31	86	R.F.	1·84	
8		0445	74	34½	17	48	74	R.F.	1·40	
9		0550	74	33½	18	07	62	R.F.	2·60	
10		0640	74	29	17	43	82	R.F.	3·18	
11		0715	74	26½	17	28	91	R.F.	2·48	
12		0750	74	24	17	14	103	R.F.	1·68	
13		0850	74	21	16	59	103	R.F.	3·34	
14		0942	74	19	16	44	134	R.F.	4·66	
15		1120	74	16	16	25	280	R.F.	3·40	
16		1248	74	14	16	57	126	R.F.	3·81	
17		1345	74	13	17	16	115	R.F.	2·88	
18		1443	74	11	17	31	106	R.F.	3·08	
19		1530	74	10½	17	47	104	R.F.	2·70	
20		1630	74	10	18	05	78	R.F.	2·23	
21		1745	74	12	18	27	56	R.F.	2·14	
22		1930	74	13	18	47	26	2-R.F.	—1·30	
23		2005	74	11	18	38	40	2-R.F.	2·34	
24		2115	74	05	18	24	70	2-R.F.	2·24	
25		2200	74	00	18	10	90	2-R.F.	3·02	
26		2340	73	54	17	56	110	2-R.F.	2·64	
27	13-1	0015	73	48	17	43	145	R.F.	2·48	
		0035					145	R.F.		
28		0120	73	40	17	28	205	R.F.	2·71	
		0145					205	R.F.		
29		0255	73	33	17	08	230	R.F.		
		0345					230	R.F.	4·09	
30		0645	73	33½	18	36	190	R.F.	3·06	
31		0815	73	42½	18	35	160	2-R.F.	2·11	
32		0945	73	51½	18	36	120	2-R.F.	3·30	
33		1110	73	57½	18	36	94	2-R.F.	2·65	
34		1225	74	02	18	45	58	R.F.	2·74	
35		1300	74	07½	18	53	40	2-R.F.	2·26	
36		1425	74	03	19	07	56	2-R.F.	2·90	
37		1530	73	56½	19	18	82	2-R.F.	2·61	
38		1650	73	55½	19	42	78	2-R.F.	3·76	
39		1800	74	03	19	51	56	2-R.F.	2·33	
40		1930	74	02	20	16	93	2-R.F.	2·26	
41		2045	73	59	20	37	126	2-R.F.	1·96	
42		2215	74	06½	20	17	70	2-R.F.	2·24	
43		2330	74	12	20	30	64	2-R.F.	1·92	
44	14-1	0820	74	07½	20	47	70	R.F.	2·51	
		0830					68	Shot T.		
45		1030	74	08	20	12	63	Hauled T.		
		1030					63	R.F.	1·63	
		1130					68	Shot T.		
46		1330	74	02	20	36	93	Hauled T.		1
		1345					93	R.F.	2·48	
		1430					100	Shot T.		
47		1630	74	06	20	00	60	Hauled T.		1
		1645					60	R.F.	1·71	
		1740					65	Shot T.		
48		1940	74	06	19	31	63	Hauled T.		2
		1950					63	R.F.	1·83	
		2045					65	Shot T.		

CRUISE I. 1950—(*contd.*)

Date 1950	Time G.M.T.	Latitude N °	Latitude N ′	Longitude E °	Longitude E ′	Sounding (Fathoms)	Gear	Bottom Temp. °C.	Catch (Baskets) Cod
14-1	2245	74	05	19	14	57	Hauled T.		40
	2255					57	R.F.	1·82	
15-1	0030	74	01	19	29	69	R.F.	2·63	
	0140	73	53	19	29	108	R.F.	2·80	
	0800	73	48	18	50	149	R.F.	1·84	
	0810					138	Shot T.		
	1010	73	48	19	12	145	Hauled T. (1)		15
	1020					145	R.F.	2·14	
	1050					140	Shot T.		
	1250	73	50	19	32	140	Hauled T. (2)		20
	1300					140	R.F.	2·56	
	1500	73	53½	19	27	105	R.F.	2·81	
	1700					108	Shot T.		
	1900	73	54½	19	53	117	Hauled T.		7
	1915					117	R.F.	2·44	
	2000					90	Shot T.		
	2200	73	59	20	00	104	Hauled T.		10
	2215					104	R.F.	2·55	
	2240					90	Shot T.		
16-1	0040	74	05	20	12	78	Hauled T.		5
	0100					78	R.F.	2·44	
	0720	74	16	20	04	64	R.F.	1·58	
	0800					64	Shot T.		
	0900	74	12	20	07	65	Hauled T. (3)		4
	1015					65	R.F.	1·43	
	1015					64	Shot T.		
	1115	74	09	20	12	64	Hauled T.		3
	1140					64	R.F.	1·82	
	1200					62	Shot T.		
	1300	74	05½	20	19	71	Hauled T.		6
	1315					71	R.F.	2·45	
	1400					70	Shot T.		
	1600	74	02½	19	52	66	Hauled T.		15
	1615					66	R.F.	1·66	
	1700					65	Shot T.		
	1900	74	01	19	20	84	Hauled T.		200
	1910					84	R.F.	2·77	
	2010					70	Shot T.		
	2220	74	01	18	58	62	Hauled T.		40
	2250					62	R.F.	2·60	
17-1	0300	74	13	19	44	41	H.S.	−0·26	
	0401–0418	74	07½	19	53	72	H.S.	2·30	
	0503–0517	74	02½	20	00	92	H.S.	2·54	
	0613–0625	73	57½	20	06	117	H.S.	2·03	
	0714–0731	73	53½	20	10	166	H.S.	1·93	
	0824–0845	73	49	20	16	219	H.S.	2·03	
	1015	73	57	20	40	164	2-R.F.	1·75	
	1110	74	05	21	12	170	R.F.	2·11	
	1155	74	10½	21	18	164	R.F.	2·52	
	1245	74	15½	21	25	110	R.F.	2·47	
	1315	74	19½	21	23	70	R.F.	2·07	
	1350	74	19½	21	06	82	R.F.	2·14	
	1430	74	19½	20	52	102	R.F.	2·24	
	1500	74	19½	20	35	106	R.F.	2·44	
	1625	74	19½	20	20	89	R.F.	1·88	
	1630					80	Shot T.		
	1830	74	21	20	40	110	Hauled T.		3
	1830					110	R.F.	2·32	
	1945					110	Shot T.		
	2145	74	24	21	08	78	Hauled T.		4

CRUISE I. 1950—(*contd.*)

Station No.	*Date 1950*	*Time G.M.T.*	*Latitude N*		*Longitude E*		*Sounding (Fathoms)*	*Gear*	*Bottom Temp. °C.*	*Catch (Baskets Cod*
			°	′	°	′				
82	17-1	2205	74	24	21	08	78	R.F.	2·23	
	18-1	0020					64	Shot T.		
83		0215	74	17	21	06	112	R.F.	2·22	
		0220					112	Hauled T.		10
84		0845	74	13½	21	14	136	R.F.	2·84	
		0900					140	Shot T.		
85		1100	74	09	21	00	154	Hauled T.		10
		1115					154	R.F.	2·22	
		1200					146	Shot T.		
86		1400	74	04	20	54	116	Hauled T.		
		1400					116	2-R.F.	2·23	
		1630					140	Shot T.		
87		1830	74	00	20	39	120	Hauled T.		180
		1835					120	2-R.F.	2·60	
		1930					120	Shot T.		
88		2130	73	58½	20	24	132	Hauled T.		60
		2315					132	2-R.F.	2·30	
89	20-1	0110	73	50	19	26	138	R.F.	2·44	
		0120					138	Shot T.		
90		0320	73	54½	19	14	82	Hauled T.		40
		0330					82	2-R.F.	2·83	
		0400					80	Shot T.		
91		0600	73	55½	18	45	100	Hauled T. (4)		

(1) 15 baskets redfish.
(2) Belly and after wing out.
(3) Footrope parted.
(4) Trawl ruined.

CRUISE II. 1950

Date 1950	Time G.M.T.	Latitude N		Longitude E		Sounding (Fathoms)	Gear	Bottom Temp. °C.	Catch (Baskets) Cod
		°	′	°	′				
15-2	1710–1720	74	23	14	18		2-H.		
	1736						R.F. (1)		
	1956–2011	74	23	15	32	791	2-H.		
	2027					787	R.F. (1)		
	2125–2135	74	23	16	10	486	2-H.		
	2150					486	R.F. (1)		
	2255–2300	74	23	16	48	129	2-H.		
	2300–2315					129	2-R.F.	2·45	
16-2	0715	74	44	16	56	102	R.F.	3·24	
	0845	74	33	17	11	96	R.F.	1·48	
	1006	74	24	17	25	94	R.F.	3·02	
	1025–1037					94	2-H.		
	1219	74	34	16	58	99	R.F.	1·89	
	1300					100	Shot T.		
	1500	74	27	16	58	108	Hauled T.		25
	1517					107	R.F.	2·34	
	1540					110	Shot T.		
	1740	74	20	16	58	116	Hauled T.		15
	1800					116	R.F.	3·22	
	1820					116	Shot T.		
	2020	74	15	17	10	112	Hauled T.		25
	2040					112	R.F.	3·04	
	2105					110	Shot T.		
	2305	74	10½	17	24	114	Hauled T.		
	2320					114	R.F.	2·20	
17-2	0055	74	01	17	38	114	R.F.	2·47	
	0215	73	55	18	07	110	R.F.	2·88	
	0325	73	53½	18	46	110	R.F.	2·80	
	0435	73	52	19	23	126	R.F.	2·18	
	0555	73	54	20	00	142	R.F.	2·27	
	0720	74	04	19	42	69	R.F.	1·06	
	0830	73	59	19	26	75	R.F.	1·40	
	0855					78	Shot T.		
	0955	73	54	19	26	90	Hauled T.		5
	1012					90	R.F.	1·90	
	1040					90	Shot T.		
	1140	73	50	19	26	125	Hauled T. (2)		10
	1205					124	R.F.	2·42	
	1300					125	Shot T.		
	1400	73	47	19	26	146	Hauled T. (3)		3
	1420					146	R.F.	2·36	
	1745					146	Shot T.		
	1845	73	46	19	22	154	Hauled T.		20
	1915					154	R.F.	2·29	
	1940					154	Shot T.		
	2040	73	44	19	23	160	Hauled T.		40
	2110					160	R.F.	2·36	
18-2	2130	73	44	19	23	159	R.F.	2·26	
	2227	73	50	18	58	127	R.F.	2·72	
	2342	73	44	18	27	158	R.F.	2·59	
19-2	0104	73	39	17	58	214	R.F. (1)		
	0230	73	49	17	58	148	R.F.	2·50	
	0345	73	55	18	06	114	R.F.	2·61	
	0515	73	51	18	39	210	R.F. (1)		
	0725	73	41	18	06	158	R.F.	2·45	
	0810					158	Shot T.		
	0940	73	41	18	17	164	Hauled T. (4)		
	1000					164	R.F.	3·04	
	1030					164	Shot T.		
	1200	73	42	18	30	160	Hauled T. (5)		1

CRUISE II. 1950—(*contd.*)

Station No.	*Date 1950*	*Time G.M.T.*	*Latitude N*		*Longitude E*		*Sounding (Fathoms)*	*Gear*	*Bottom Temp. °C.*	*Ca. (Bas. Co*
			°	′	°	′				
34	19-2	1207	73	42	18	30	160	R.F.	2·78	
		1245					160	Shot T.		
35		1415	73	43	18	42	160	Hauled T.		1
		1445					160	R.F.	2·44	
		1500					160	Shot T.		
36		1630	73	44	18	55	164	Hauled T.		1
		1655					162	R.F.	2·40	
		1720					164	Shot T.		
37		1850	73	45	19	08	160	Hauled T.		
		1910					160	R.F.	2·42	
		2005					164	Shot T.		
38		2135	73	46	19	28	158	Hauled T.		
		2157					158	R.F.	2·40	
39	20-2	0805	73	54	20	06	155	R.F.	2·04	
		0845					164	Shot T.		
40		1045	73	51	19	53	150	Hauled T. (6)		
		1104					155	R.F.	2·40	
		1200					150	Shot T.		
41		1400	73	48½	19	37	147	Hauled T. (7)		
		1423					147	R.F.	2·10	
		1440					145	Shot T.		
42		1640	73	48½	19	24	142	Hauled T.		
		1650					142	R.F.	2·38	
		1720					145	Shot T.		
43		1920	73	51½	19	12	117	Hauled T.		
		1936					115	R.F.	1·98	
		2000					115	Shot T.		
44		2200	73	55	18	56	106	Hauled T.		
		2210					106	R.F.	2·42	
		2230					106	Shot T.		
45	21-2	0030	73	55	18	34	95	Hauled T.		
		0040					95	R.F.	2·49	
46		1100	73	56	18	12	110	R.F.	2·07	
		1140					110	Shot T.		
47		1335	73	59	17	49	115	R.F.	2·36	
		1340					115	Hauled T. (8)		
		1450					115	Shot T.		
48		1630	73	59	17	34	120	Hauled T.		
		1645					120	R.F.	2·56	
		1715					120	Shot T.		
49		1915	73	54	17	50	125	Hauled T.		
		1928					125	R.F.	2·56	
		1950					125	Shot T.		
50		2150	73	56	18	12	110	Hauled T.		
		2203					110	R.F.	2·36	
		2320					110	Shot T.		
51	22-2	0020	73	56	17	56	120	Hauled T.		

(1) No temp. taken close to bottom.
(2) Selvedge of wing parted.
(3) Holes in lengthening piece and wings. 2 large rocks in catch.
(4) 60 baskets, mostly redfish.
(5) 10 baskets redfish.
(6) 150 baskets redfish.
(7) 35 baskets redfish.
(8) 80 baskets redfish.

CRUISE III. 1950

Date 1950	Time G.M.T.	Latitude N		Longitude E		Sounding (Fathoms)	Gear	Bottom Temp. °C.	Catch (Baskets) Cod
		°	′	°	′				
16-3	2105–2215	70	46	21	14	118	H.S., B.T., 2-H., F.	5·68	
17-3	0015–0115	71	06	21	04	105	H.S., B.T., 2-H., F.	5·58	
	0317–0455	71	25	20	54	176	H.S., B.T., 2-H., F.	4·76	
	0725–0828	71	55	20	35	198	H.S., B.T., H., F.(1)	4·81	
	1118–1220	72	24	20	18	188	H.S., B.T.	2·93	
	1954	72	54	20	01	236	H.S. (2)		
18-3	2050–2103	74	08	19	14	45	H.S., B.T.	− 1·15	
	2251–2321	73	53	19	24	110	B.T., H.S.	2·26	
19-3	0058–0127	73	43	19	30	166	H.S., B.T.	2·13	
	0219–0254	73	38	19	33	192	B.T., H.S. (3)		
	0445–0524	73	28	19	40	262	H.S., B.T.	2·12	
	0701–0739	73	19	19	46	258	B.T., H.S.	2·14	
	1955–2021	72	54	20	01	232	H.S., B.T. (3)		
20-3	1406–1525	74	25	17	24	97	B.T., H.S., 2-H.	1·40	
	1640–1730	74	25	16	46	124	H.S., B.T., 2-H.	2·10	
	1810–1900	74	25	16	27	154	B.T., H.S., 2-H.	3·56	
	2001–2040	74	25	16	08	510	H.S., B.T. (3)		
	2155–2305	74	25	15	30		B.T., H.S., 2-H. (4)		
21-3	0115–0202	74	25	14	15		H.S., B.T., 2-H. (4)		
	0406–0455	74	25	13	00	1210	B.T., H.S., 2-H. (3)		
	1049	74	30	16	24	234	R.F.	3·40	
	1135	74	30	16	42	140	R.F.	2·81	
	1221	74	30	17	00	104	R.F.	1·57	
	1255	74	31	17	20	90	R.F.	1·76	
	1349	74	31	17	38	74	R.F.	1·80	
	1425	74	32	17	50	64	R.F.	1·90	
	1540	74	24	17	28	90	R.F.	2·29	
	1625	74	24	17	48	68	R.F.	1·67	
	1742	74	13	17	53	98	R.F.	1·78	
	1851	74	05	18	06	78	R.F.	1·50	
	1945	74	01½	17	52	112	R.F.	2·49	
	2034	74	00	17	34	134	R.F.	2·71	
	2120	74	00	17	16	140	R.F.	2·88	
	2206	73	55	17	06	158	R.F.	3·16	
	2250	73	50	16	55	195	R.F.	2·60	
	2355	73	58	16	49	178	R.F.	2·05	
22-3	0035	74	01	17	02	146	R.F.	2·98	
	0120	74	05	17	15	136	R.F.	3·04	
	0315	74	12	16	28	258	R.F.	3·52	
	0400	74	12	16	48	154	R.F.	2·91	
	0452	74	12	17	10	120	R.F.	2·86	
	0540	74	12	17	21	108	R.F.	2·25	
	1032	73	49	16	06	234	R.F.	4·28	
	1100					250	Shot T.		
	1300	73	52	16	06	250	Hauled T. (5)		2
	1317					250	R.F.	4·03	
	1500					220	Shot T.		
	1700	73	55	16	24	180	Hauled T.		12
	1709					180	R.F.	4·40	
	1745					180	Shot T.		
	1945	74	02	16	50	140	Hauled T. (6)		3
	1950					140	R.F.	2·76	
	2140					140	Shot T.		
	2340	74	06	17	22	117	Hauled T. (7)		3
	2356					117	R.F.	2·78	
23-3	0830	74	06	17	22	115	R.F.	2·77	
	0840					115	Shot T.		
	1040	74	08	17	45	115	Hauled T. (8)		
	1048					112	R.F.	1·42	
	1120					115	Shot T.		

CRUISE III. 1950—(*contd.*)

Station No.	Date 1950	Time G.M.T.	Latitude N		Longitude E		Sounding (Fathoms)	Gear		Bottom Temp. °C.	C (Ba
			°	′	°	′					
50	23-3	1320	74	12	18	05	105	Hauled T.			
		1330					105	R.F.		1·25	
51		1530	74	20	17	30	103	R.F.		2·14	
		1815					103	Shot T.			
52		2015	74	17	17	07	101	Hauled T.			
		2020					101	R.F.		2·72	
		2110					101	Shot T.			
53		2310	74	14	16	41	150	Hauled T.			
		2320					150	R.F.		2·76	
54	24-3	0520	74	11	19	12	38	R.F.		− 1·66	
55		0635	74	01	19	18	70	R.F.		− 0·52	
56		0740	73	56	19	22	74	R.F.		1·61	
57		0855	73	58	18	50	78	R.F.		2·18	
		0910					78	Shot T.			
58		1110	73	52	18	40	127	Hauled T.			
		1115					127	R.F.		2·12	
		1150					160	Shot T.			
59		1350	73	45	18	34	185	Hauled T.			
		1400					160	R.F.		2·35	
		1630					155	Shot T.			
60		1830	73	37	18	34	185	Hauled T.			
		1840					187	R.F.		2·18	
		2015					187	Shot T.			
61		2215	73	31	18	34	227	Hauled T.	(9)		
		2240					227	R.F.		2·26	
62	25-3	0815	73	49	18	00	137	R.F.		2·00	
		0815					137	Shot T.			
63		1015	73	47	18	24	153	Hauled T.			
		1030					153	R.F.		2·32	
		1115					153	Shot T.			
64		1315	73	45	18	51	158	Hauled T.	(10)		
		1330					158	R.F.		2·26	
		1530					158	Shot T.			
65		1730	73	49	18	48	138	Hauled T.	(11)		
		1745					138	R.F.		2·24	
		1815					125	Shot T.			
66		2015	73	50	19	08	125	Hauled T.			
		2015					125	R.F.		2·12	
		2050					120	Shot T.			
67		2250	73	51	19	28	125	Hauled T.			
		2300					125	R.F.		2·08	
		2345					130	Shot T.			
68	26-3	0045	73	52	19	37	125	Hauled T.			
		0051					127	R.F.		1·87	
69		0230	73	52	20	12	176	R.F.		2·34	
70		0355	73	52	20	46	236	R.F.		2·12	
71	28-3	1315	74	00	18	00	100	R.F.		1·60	
		1410					100	Shot T.			
72		1610	74	03	17	40	115	Hauled T.			
		1620					114	R.F.		3·05	
		1645					142	Shot T.			
73		1845	73	55	17	27	140	Hauled T.			
		1915					142	R.F.		2·80	
74	29-3	0815	72	32	18	00	195	R.F.		3·73	
		0830					195	Shot T.			
75		1030	72	26	18	00	200	Hauled T.	(12)		
		1050					200	R.F.		4·54	

(1) Hensen net split. No plankton hauls made.
(2) Station abandoned after one series. No temp. taken close to bottom.
(3) No temp. taken close to bottom.
(4) No sounding recorded.
(5) Split in after bunt and belly. 10 baskets redfish.
(6) After wing out.
(7) Both wings and belly out.
(8) Trawl possibly not on bottom.
(9) 50 baskets redfish.
(10) 5 baskets redfish.
(11) 15 baskets redfish.
(12) Belly badly torn.

CRUISE IV. 1950

Date 1950	Time G.M.T.	Latitude N		Longitude E		Sounding (Fathoms)	Gear	Bottom Temp. °C.	Catch (Baskets) Cod
		°	′	°	′				
26-4	1305–1335	73	00	12	40		2-H.		
26/7-4	2210–0035	74	25	13	56	1167	5-H., F.		
27-4	0255–0407	74	26	15	10	890	4-H., F.		
	0545–0603	74	27	15	57	510	2-H., F.		
	0725–0800	74	28	16	35	124	2-H., F.		
	0820					132	R.F.	4·85	
	0943–1020	74	28	17	13	94	F., 4-H.		
	1039					94	R.F.	1·54	
	1150–1227	74	29	17	52	66	2-H., F.		
	1238					66	R.F.	1·99	
	1340–1357	74	29	18	22	42	2-H., F.		
	1410					44	R.F.	0·65	
	1554	74	32½	17	46	68	R.F.	1·56	
	1600					68	R.F.		
	1653	74	35	17	19	90	R.F.	2·17	
	1657					90	R.F.		
	1759	74	38	16	52	104	R.F.	1·72	
	1905	74	42	16	22	145	R.F.	5·18	
	1910					145	R.F.		
	2012	74	34	16	25	170	R.F.	5·24	
	2145	74	20	16	37	146	R.F.	4·04	
	2318	74	20	17	04	110	R.F.	1·30	
28-4	0045	74	20	17	38	92	R.F.	2·02	
30-4	0817	74	26	18	08	63	R.F.	1·18	
	0823					63	R.F.		
	0845					62	Shot T.		
	1045	74	25½	17	45	66	Hauled T.		
	1055					66	R.F.	1·26	
	1130					66	Shot T.		
	1330	74	25	17	25	86	Hauled T.		
	1335					86	R.F.	2·41	
	1410					86	Shot T.		
	1610	74	25	17	06	96	Hauled T.		14
	1616					96	R.F.	2·05	
	1650					96	Shot T.		
	1850	74	24½	16	45	135	Hauled T. (1)		10
	1902					135	R.F.	3·08	
	2000					135	Shot T.		
	2200	74	24½	16	28	178	Hauled T.		15
	2214					178	R.F.	4·19	
1-5	0050	74	11½	17	08	124	R.F.	2·06	
	0200	74	08	17	36	112	R.F.	3·03	
	0313	74	04	18	06	84	R.F.	1·29	
	0415	73	57	17	40	120	R.F.	2·32	
	0525	73	50	17	16	164	R.F.	2·21	
	0635	73	51½	16	40	196	R.F.	4·70	
	0730					196	Shot T.		
	0930	73	55	16	48	177	Hauled T. (2)		
	0950					176	R.F.	3·58	
	1030					175	Shot T.		
	1230	73	59½	17	00	140	Hauled T. (3)		
	1252					143	R.F.	4·11	
	1330					140	Shot T.		
	1530	74	04	17	11	128	Hauled T. (4)		
	1545					127	R.F.	2·20	
	1625					128	Shot T.		
	1825	74	08	17	21	114	Hauled T.		7
	1845					114	R.F.	2·00	
2-5	1012	74	49	25	12	124	R.F.	2·39	
	1045					130	Shot T.		

CRUISE IV. 1950—(*contd.*)

Station No.	*Date 1950*	*Time G.M.T.*	*Latitude N*		*Longitude E*		*Sounding (Fathoms)*	*Gear*	*Bottom Temp. °C.*	*Co (Ba C*
			°	′	°	′				
34	2-5	1245	74	45	25	04	133	Hauled T.		
		1258					132	R.F.	1·89	
		1330					133	Shot T.		
35		1530	74	41	25	28	160	Hauled T.		
		1537					158	R.F.	2·46	
		1610					160	Shot T.		
36		1810	74	41	25	52	164	Hauled T. (5)		
		1835					162	R.F.	2·42	
		1925					164	Shot T.		
37		2125	74	41	26	15	178	Hauled T.		
		2145					176	R.F.	2·23	
38	3-5	0650	74	48	26	44	166	R.F.	2·46	
		0705					165	Shot T.		
39		0805	74	48	26	58	170	Hauled T. (6)		1
		0823					173	R.F.	2·63	
		1000					170	Shot T.		
40		1100	74	45½	26	38	164	Hauled T.		
		1128					164	R.F.	2·59	
		1345					165	Shot T.		
41		1445	74	42½	26	25	164	Hauled T.		
		1505					162	R.F.	2·34	
		1530					164	Shot T.		
42		1630	74	44	26	38	164	Hauled T.		
		1717					162	R.F.	2·82	
		1745					165	Shot T.		
43		1845	74	48	26	38	165	Hauled T.		
		1915					165	R.F.	2·52	
		1940					165	Shot T.		
44		2040	74	52	26	36	155	Hauled T.		
		2118					153	R.F.	2·20	
		2145–2233					153	1m.St.		
45	4-5	0645	74	16	22	12	104	R.F.	2·31	
		0745					100	Shot T.		
46		0945	74	10	21	51	160	Hauled T (7)		
		1005					158	R.F.	2·86	
		1030					160	Shot T.		
47		1230	74	08	21	34	135	Hauled T.		
		1248					134	R.F.	2·26	
		1315					135	Shot T.		
48		1515	74	11	21	22	130	Hauled T. (8)		
		1525					132	R.F.	2·48	
		1645					135	Shot T.		
49		1845	74	16	21	06	118	Hauled T.		
		1900					115	R.F.	2·65	
		1915					118	Shot T.		
50		2115	74	21½	20	48	118	Hauled T.		
		2133					118	R.F.	2·20	
		2150–2245						1m.St.		
51	5-5	0150–0209	74	16	19	10	34	2-H., F.		
		0237					34	R.F. (9)		
52		0323–0405	74	08	19	14	64	2-H., F., R.F.	0·61	
53		0537–0605	73	53	19	24	126	2-H., F.		
		0612					126	R.F.	2·21	
54		0715–0755	73	43	19	30	226	2-H.,F.,R.F.(9)		
55		0920–1000	73	28	19	40	264	2-H.,F.,R.F.	2·27	
56		1059–1120	73	19	19	46	259	H., F. (10)		

(1) Small hole in wing. 10 baskets redfish.
(2) Hole in cod-end.
(3) Cod-end out.
(4) Small hole in cod-end.
(5) Cod-end split on hauling.
(6) Hole in bunt.
(7) Small hole in trawl.
(8) 150 baskets redfish. Hole in lengthening
(9) No temp. taken close to bottom.
(10) Small tear in Hensen net after haul 1.

CRUISE V. 1950

Date 1950	Time G.M.T.	Latitude N		Longitude E		Sounding (Fathoms)	Gear		Bottom Temp. °C.	Catch (Baskets) Cod
		°	′	°	′					
27-5	2110	74	25	13	10	1200	2-R.F., B.T.	(11)		
	2330	74	23½	14	26	1030	2-R.F.	(11)		
	2330–2345					1076	2-H.			
	2350						B.T.			
28-5	0140	74	22	15	44	712	2-R.F.	(11)		
	0140–0155					712	2-H.			
	0207					712	B.T.			
	0305	74	21½	16	24	228	3-R.F.	(11)		
	0305–0315					228	2-H.			
	0353						B.T.			
	0425	74	21	16	42	134	3-R.F.		3·08	
	0425–0440					132	2-H.			
	0504						B.T.			
	0530–0617	74	20½	17	00	118	3-R.F., 2-H., B.T.		3·34	
	0714–0804	74	20	17	36	88	3-R.F., 2-H., B.T.		2·36	
	0905	74	19½	18	18	54	3-R.F.		1·04	
	0907–0917					54	2-H.			
	0920						B.T.			
	1021–1030	74	19	18	38	24	2-H.			
	1040					25	3-R.F.		− 0·86	
	1050						B.T.			
	1300	74	29	17	54	64	R.F.		1·68	
	1325					65	Shot T.			
	1525	74	31½	17	28	75	Hauled T.	(1)		1
	1530					75	R.F.		1·61	
	1620					78	Shot T.			
	1820	74	38	17	14	86	Hauled T.			15
	1820					86	R.F.		2·65	
	1900					86	Shot T.			
	2100	74	44	16	58	86	Hauled T.	(2)		50
	2100					86	R.F.		2·72	
	2135					160	Shot T.			
	2335	74	50½	16	43	155	Hauled T.			10
	2345					160	R.F.		3·08	
29-5	0610	74	33	16	22	169	R.F.		3·91	
	0715	74	33½	16	10	260	R.F.		3·63	
	0805	74	29	16	20	242	R.F.		3·23	
	0925–0945	74	21	16	26	232	R.F., A.	(3)	3·12	
	1104	74	13	16	30	258	R.F.		2·84	
	1205	74	08	16	35	150	R.F.		2·74	
	1235					150	Shot T.			
	1335	74	13	16	34	145	Hauled T.	(4)		120
	1400					145	R.F.		3·28	
	1500	74	18	16	34	150	R.F.		4·02	
	1535					150	Shot T.			
	1635	74	23½	16	34	150	Hauled T.			200
	1655					143	R.F.		3·26	
	1815	74	28	16	30	150	2-R.F.		3·80	
	1850					150	Shot T.			
	1950	74	27½	16	34	140	Hauled T.			80
	2000					156	R.F.		4·16	
	2115	74	35	16	34	144	R.F.		3·38	
	2140					140	Shot T.			
	2240	74	40	16	36	120	Hauled T.			
	2250					120	R.F.		3·02	
30-5	0100	74	34½	16	52	100	2-R.F.		2·88	
	0150	74	29½	17	10	95	2-R.F.		2·11	
	0305	74	26	17	30	86	2-R.F.		2·78	
	0635					85	Shot T.			
	0735	74	22½	17	40	100	Hauled T.	(5)		20

CRUISE V. 1950—(*contd.*)

Station No.	*Date 1950*	*Time G.M.T.*	*Latitude N*		*Longitude E*		*Sounding (Fathoms)*	*Gear*		*Bottom Temp. °C.*	*Ca (Bas C.*
			°	′	°	′					
31	30-5	0740	74	22½	17	40	85	R.F.		2·32	
32		0855	74	22½	17	30	98	R.F.		2·86	
		1000					100	Shot T.			
33		1100	74	24	17	20	100	Hauled T.			2
		1110					100	R.F.		3·39	
34		1145	74	21½	17	07	112	R.F.		3·02	
		1215					110	Shot T.			
35		1315	74	18	17	09	117	Hauled T.			3
		1330					115	R.F.		3·36	
36a		1440	74	15½	16	57	130	Shot T.			
36		1540	74	17½	16	47	132	Hauled T.			
		1600					132	R.F.		2·94	
37		1630	74	16	16	34	148	R.F.		2·68	
		1700					145	Shot T.			
38		1800	74	13	16	38	150	Hauled T.			1
		1820					146	R.F.		2·66	
		2005					150	Shot T.			
39		2105	74	09	16	32	163	Hauled T.	(6)		1
		2115					163	R.F.		2·71	
40		2230	74	12½	16	40	160	A.	(7)		
		2250					150	1m.St.			
	30/31-5	2345–0020					143	H.S.		2·74	
41	31-5	0130	74	02	16	30	168	R.F.		3·22	
42		0250	73	56	17	00	145	R.F.		2·56	
43		0640	73	46	16	55	210	R.F.		2·94	
		0725					210	Shot T.			
44		0840	73	45	17	07	206	Hauled T.	(5)		
		0900					206	R.F.		2·58	
45		1010	73	49	17	18	166	R.F.		2·42	
		1035					168	Shot T.			
46		1150	73	53	17	11	149	Hauled T.			
		1200					149	R.F.		2·65	
47		1300	73	59	17	22	140	R.F.		2·64	
		1325					135	Shot T.			
48		1425	73	56½	17	30	133	Hauled T.			
		1440					133	R.F.		2·67	
49		1530	73	59½	17	33	112	R.F.		2·72	
		1600					112	Shot T.			
50		1700	74	02½	17	36	116	Hauled T.			
		1715					116	R.F.		2·67	
51		1800	74	06	17	48	112	R.F.		2·22	
		1820					112	Shot T.			
52		1920	74	03	17	54	118	Hauled T.			
		1930					118	R.F.		2·78	
53		2010	74	06½	18	05	82	R.F.		2·52	
		2035					87	Shot T.			
54		2145	74	10	17	52	99	Hauled T.			
		2155					99	R.F.		2·38	
		2220					100	A.			
55	31-5/1-6	2342–0055	74	13½	18	10	68	2-A., R.F.	(8)	1·24	
56	1-6	0745	74	07	18	16	69	R.F.		2·20	
		0815					70	Shot T.			
57		0915	74	09½	18	04	80	Hauled T.			
		0925					80	R.F.		2·42	
58		1055	74	03½	17	32	116	R.F.		2·63	
		1120					116	Shot T.			
59		1320	74	04	17	06	130	Hauled T.	(5)		
		1320					130	R.F.		2·57	
		1420					135	Shot T.			
60		1620	74	08	16	38	150	Hauled T.			

CRUISE V. 1950—(*contd.*)

Date 1950	Time G.M.T.	Latitude N °	′	Longitude E °	′	Sounding (Fathoms)	Gear		Bottom Temp. °C.	Catch (Baskets) Cod
1-6	1625	74	08	16	38	148	R.F.		2·86	
	1845	74	05	16	33	160	Long lines			
	2030–2150	74	08	16	26	180	2-A.	(9)		
	2335	74	25	16	25	214	R.F.		3·48	
2-6	0105	74	38	16	12	176	R.F.		3·14	
	0700	74	41	16	12	130	R.F.		1·84	
	0735					140	Shot T.			
	0835	74	44	16	16	160	Hauled T.			
	0845					160	R.F.		2·68	
	0925					170	Shot T.			
	1025	74	44	16	36	135	Hauled T.			25
	1040					133	R.F.		3·44	
	1135					140	Shot T.			
	1230	74	43½	17	02	125	R.F.		2·86	
	1235					125	Hauled T.			1
	1315	74	42½	17	02	80	R.F.		3·20	
	1330					120	Shot T.			
	1530	74	41	17	36	85	Hauled T.			160
	1540					60	R.F.		2·05	
	1630					60	Shot T.			
	1730	74	39½	18	00	74	Hauled T.			1
	1740					74	R.F.		1·94	
	1820					70	Shot T.			
	2020	74	38	17	30	68	Hauled T.	(10)		
	2030					68	R.F.		2·32	
	2210–2220					75	A.			
3-6	0640	74	45	18	16	122	R.F.		2·88	
	0720					130	Shot T.			
	0820	74	45	18	00	126	Hauled T.			
	0835					126	R.F.		1·06	
	0930	74	45	17	38	140	R.F.		2·68	
	0950					125	Shot T.			
	1050	74	45	17	23	140	Hauled T.			10
	1110					142	R.F.		2·17	
	1250	74	32	16	50	102	R.F.		2·46	
	1315					100	Shot T.			
	1515	74	28	17	05	97	Hauled T.			40
	1525					97	R.F.		2·33	
	1705	74	14	17	18	110	R.F.		2·36	
	1740					110	Shot T.			
	1840	74	10½	17	28	110	Hauled T.			5
	1855					110	R.F.		2·34	
	1920					110	Shot T.			
	2020	74	09	17	12	120	Hauled T.			15
	2035					120	R.F.		2·94	
4-6	0640	74	16½	16	26	253	R.F.		3·22	
	0836–0900	74	16½	16	26	250	H.S.	(11)		
	1010–1028	74	17	16	36	139	H.S.	(11)		
	1128–1148	74	17½	16	46	132	H.S.	(11)		
	1245–1305	74	18½	17	08	108	H.S.	(11)		
	1407–1422	74	20	17	30	95	H.S.		2·70	
	1535	74	21	17	53	71	H.S.		0·62	
	1758	74	16	19	09	32	3-R.F.		0·20	
	1806–1820						2-H.			
	1830						B.T.			
	1920	74	08	19	14	58	3-R.F.		0·93	
	1920–1930						2-H			
	2005						B.T.			
	2125–2230	73	53	19	24	134	2-H., 3-R.F., B.T.		2·40	
4/5-6	2320–0010	73	43	19	30	190	2-H., 2-R.F., B.T.	(11)		

CRUISE V. 1950—(*contd.*)

Station No.	*Date* 1950	*Time G.M.T.*	*Latitude N*		*Longitude E*		*Sounding (Fathoms)*	*Gear*	*Bottom Temp. °C.*	*Cat (Bask Co*
			°	′	°	′				
93	5-6	0135 0135–0145 0200	73	28	19	40	260	2-R.F. **(11)** 2-H. B.T.		
94		0245 0255–0305 0315	73	19	19	46	248	2-R.F. **(11)** 2-H. B.T.		

(1) Cod-end blinded with shrimp netting inside for 1 haul only.
(2) 10 baskets haddock.
(3) Agassiz. Net fouled wire. No catch.
(4) 40 baskets redfish.
(5) Net slightly torn.
(6) Belly out.
(7) Vertical hauls with A., 1m. St. attempting to sam the cause of extensive echo traces.
(8) First Aggasiz haul foul.
(9) Aggasiz—1st haul foul, 2nd haul foul (s specimens retained).
(10) Extensive damage to trawl.
(11) No temp. taken close to bottom.

CRUISE VI. 1950

tion p.	Date 1950	Time G.M.T.	Latitude N		Longitude E		Sounding (Fathoms)	Gear		Bottom Temp. °C.	Catch (Baskets) Cod
			°	′	°	′					
1	26-6	2215	70	46	21	14	124	B.T.			
		2251–2315					124	H.S.	(1)		
2	27-6	0148–0212	71	06	21	04	103	H.S.		6·03	
		0220					103	B.T.			
3		0445	71	25	20	54	157	B.T.			
		0518–0539					157	H.S.		5·06	
4		0915–0938	71	55	20	35	205	H.S.	(1)		
		0945					205	B.T.			
5		1525	72	24	20	18	212	B.T.			
		1600–1628					212	H.S.		2·60	
6	28-6	1915	72	54	20	01	235	B.T.			
		1936–2001					235	H.S.	(1)		
7		2237	73	19	19	46	257	H.			
		2246–2312					257	H.S.	(1)		
		2335					257	B.T.			
8	29-6	0102	73	28	19	40	261	B.T.			
		0138–0226					261	H.S.	(1)		
9		0354–0414	73	38	19	33	221	H.S.	(1)		
		0424					221	B.T.			
0		0512	73	43	19	30	176	B.T.			
		0536–0609					176	H.S.	(1)		
1		0735–0752	73	54	19	22	90	H.S.	(1)		
		0801					90	B.T.			
2		0939	74	10	19	12	39	B.T.			
		1004					39	H.S.		1·78	
3		1115	74	19	19	06	19	H.S.		1·10	
4	30-6	0553–0642	74	25	18	32	28	H.S., 2-H.		1·25	
5		0747–0808	74	25	18	02	69	H.S.	(1)		
		0812					69	B.T.			
6		0919	74	25	17	24	92	B.T.	(2)		
7	3-7	0632–0723	74	25	18	02	68	H.S., B.T., 2-H., F.	(1)		
8		0801	74	25	17	43	74	W/B.		2·64	
9		0837–0957	74	25	17	24	96	H.S., 2-H., F., B.T.		2·73	
0		1030	74	25	17	06	108	W/B.		3·67	
1		1105–1205	74	25	16	46	130	H.S., 2-H., F., B.T.		3·85	
2		1311	74	25	16	27	188	B.T.			
		1333–1422					188	H.S.		3·19	
3		1456–1630	74	25	16	08	520	H.S., 2-H., F., B.T.	(1)		
4		1731	74	26	15	30	796	B.T.			
		1738–1752					796	2-H., F.			
		1758–1905					796	H.S.	(1)		
5		2105–2236	74	27	14	15	1134	H.S., 2-H., F., B.T.	(1)		
6	4-7	0029	74	29	13	00	1246	B.T.			
		0052–0125					1246	H.S.	(1)		
7		0747	74	49½	16	03	181	R.F.		3·65	
8		0844	74	49½	16	40	184	R.F.		4·34	
9		0931	74	45	16	54	138	R.F.		4·23	
0		1018	74	40½	17	03	96	R.F.		2·48	
1		1124	74	46	17	30	125	R.F.		2·51	
2		1212	74	47	17	35	159	R.F.		1·83	
3		1342	74	41	18	05	106	R.F.		2·94	
4		1427	74	39½	18	21	72	R.F.		2·38	
5		1539	74	45	18	21	107	R.F.		2·64	
6		1647	74	45	18	41	84	R.F.		1·28	
7		1750	74	40	18	46	40	R.F.		1·52	
8		1902	74	34½	18	30	40	R.F.		1·52	
9		2002	74	37	18	09	87	R.F.		2·09	
0		2104	74	38	17	49	60	R.F.		2·64	
1		2157	74	39	17	21	79	R.F.		2·34	
2		2317	74	41½	16	38	143	R.F.		3·76	

CRUISE VI. 1950—(*contd.*)

Station No.	*Date 1950*	*Time G.M.T.*	*Latitude N*		*Longitude E*		*Sounding (Fathoms)*	*Gear*	*Bottom Temp. °C.*	*Catch (Baske Cod*
			°	′	°	′				
43	5-7	0008	74	42	16	16	158	R.F.	4·26	
44		0122	74	33	16	25	156	R.F.	4·07	
45		0220	74	32	16	50	104	R.F.	3·75	
46		0315	74	31½	17	17	92	R.F.	3·16	
47		0408	74	30	17	45	66	R.F.	2·10	
48		0509	74	29½	18	11	50	R.F.	2·36	
		0548–0635					50	1m.St.		
49		0800–0842	74	38	18	21	75	1m.St.		
50		0954–1035	74	40	17	40	62	1m.St.		
51		1147–1235	74	28½	17	09	94	1m.St.		
52		1337–1422	74	25	16	38	134	1m.St.		
53		1528	74	15	16	33	154	R.F.	2·91	
54		1625	74	15	16	50	130	R.F.	2·71	
55		1712	74	15	17	09	108	R.F.	2·80	
56		1753	74	15	17	28	95	R.F.	2·86	
57		1835	74	15	17	46	96	R.F.	1·88	
58		1915	74	15	18	05	75	R.F.	2·18	
59		2000	74	15	18	13	41	R.F.	1·54	
		2010–2050					41	1m.St.		
60	6-7	0520–0536	74	16	19	08	32	2-H., R.F., F.	1·04	
61		0640–0712	74	06	19	00	43	2-H., R.F., F.	2·57	
62		0811–0852	73	56½	18	52	95	3-H., R.F., F. (3)	2·18	
63		0950	73	46½	18	44	141	R.F.	2·43	
		0955–1010					141	2-H., F.		
64		1115	73	37	18	35	183	R.F.	2·47	
		1120–1138					183	2-H., F.		
65		1244–1405	73	26	18	25	247	2-H., F., R.F., 1m.St. (4)	2·26	
66		1533	73	39½	18	00	197	R.F.	2·42	
67		1648	73	49	18	08	142	R.F.	2·43	
68		1756	73	59	18	16	94	R.F.	2·17	
69		1951	73	59	19	34	80	R.F.	2·03	
70		2040	74	00	20	03	93	R.F.	2·44	
71		2153	74	08	20	05	70	R.F.	1·51	
		2202–2247					70	1m.St.		
72		2359	74	17½	20	06	62	R.F.	0·47	
	7-7	0007–0049					62	1m.St.		
73		0349	74	07	18	24	70	R.F.	2·48	
74		0448	74	07	17	54	84	R.F.	2·45	
75		0549	74	07	17	24	112	R.F.	2·48	
76		0651	74	07	16	54	130	R.F.	2·85	
77		0755	74	07	16	24	186	R.F.	3·12	
78		0857	73	59	16	24	172	R.F.	2·73	
79		1003	73	59	16	50	142	R.F.	2·40	
80		1058	73	59	17	20	136	R.F.	2·63	
		1106–1155					136	1m.St.		
81		1235	73	59	17	50	110	R.F.	2·57	
82		1338	73	50½	17	31	158	R.F.	2·56	
83		1450	73	42	17	15	219	R.F.	2·38	
84		1555	73	49	16	51	200	R.F.	2·52	
85		1709	73	49	16	17	230	R.F.	2·57	

(1) No temp. taken close to bottom.
(2) Station abandoned after B.T. lowering due to swell and sea.
(3) 2nd Hensen haul not fishing properly.
(4) Fine net silk slightly torn.

CRUISE VII. 1950

tion No.	Date 1950	Time G.M.T.	Latitude N °	′	Longitude E °	′	Sounding (Fathoms)	Gear	Bottom Temp. °C.	Catch (Baskets) Cod
1	4-8	1618	73	19	19	44	260	2-R.F., B.T.	2·01	
		1640–1700					260	2-H.		
2		1802	73	28	19	40	264	2-R.F., B.T.	1·97	
		1810–1825					262	2-H.		
3		2000–2010	73	45	19	32	167	2-H.		
		2020					167	2-R.F., B.T.	2·60	
4		2125–2155	73	54	19	25	83	2-R.F., B.T., 2-H.	2·62	
5		2315	74	08	19	18	44	2-R.F., B.T.	1·56	
		2315–2330					44	2-H.		
6	5-8	0025	74	16*	19	11	30	R.F. (1)		
		0030–0040					30	2-H., B.T.		
7		0212	74	19½	20	00	56	R.F.	0·59	
8		0335	74	11	20	16	65	R.F.	1·45	
9		0440	74	01½	20	32	97	R.F.	1·66	
10		0602	73	54	20	43	180	R.F.	2·01	
11		0720	73	49	19	56	154	R.F.	2·50	
12		0950	73	41	18	30	164	R.F.	2·52	
13		1045	73	49	18	32	132	R.F.	2·55	
14		1130	73	55½	18	32	105	R.F.	2·41	
15		1225	74	03½	18	34	61	R.F.	2·84	
16		1315	74	10	18	33	41	R.F.	1·68	
17		1405	74	17	18	31	33	R.F.	2·04	
18		1626	74	18½	18	05	104	R.F.	2·96	
19		1800	74	08	17	56	88	R.F.	3·29	
20		1920	73	57	17	49	114	R.F.	2·72	
21		2047	73	44	17	39	184	R.F.	2·42	
22		2210	73	32	17	30	232	R.F.	2·17	
23	6-8	0007	73	45	16	47	206	R.F.	2·30	
24		0140	73	55	17	20	140	R.F.	2·58	
25		0327	73	56	16	12	218	R.F.	2·72	
26		0423	73	59	16	40	160	R.F.	2·56	
27		0548	74	06	17	27	119	R.F.	3·29	
28		0712	74	16	17	43	94	R.F.	3·26	
29		0835	74	13½	17	09	116	R.F.	4·52	
30		0950	74	13½	16	30	232	R.F.	3·25	
31		1122–1155	74	25	16	27	217	2-H., R.F., F.	2·78	
32		1225–1254	74	26	16	47	136	2-H., R.F., F.	2·84	
33		1325	74	26½	17	05	106	R.F.	3·82	
34		1407–1435	74	27	17	23	95	2-H., R.F., F.	3·26	
35		1508	74	27½	17	42	80	R.F.	3·30	
36		1550	74	28	17	59	65	R.F.	3·00	
		1555–1612					66	2-H., F.		
37		1715–1732	74	28½	18	19	40	2-H., R.F., F.	2·10	
38		1820	74	35	18	16	60	R.F.	2·27	
39		1908	74	40½	18	13	94	R.F.	3·70	
40		1954	74	48	18	15	135	R.F.	3·11	
41		2100	74	54	18	23	81	R.F.	3·45	
42		2200	75	00	18	14	44	R.F.	2·88	
43		2250	74	54	18	02	92	R.F.	3·20	
44		2350	74	46	17	52	129	R.F.	3·99	
45	7-8	0050	74	36	17	42	62	R.F.	4·30	
46		0155	74	39½	17	16	79	R.F.	3·20	
47		0240	74	43	16	51	96	R.F.	3·64	
48		0640	74	42	17	00	90	R.F.	3·32	
		0715					92	Shot T. + C.1		
49		0845	74	39	17	22	78	Hauled T.		30
		0905					76	R.F.	3·00	
		0940					78	Shot T. + C.1		
50		1110	74	39½	17	40	80	Hauled T.		
		1125					64	R.F.	4·46	

CRUISE VII. 1950—(*contd.*)

Station No.	*Date 1950*	*Time G.M.T.*	*Latitude N*		*Longitude E*		*Sounding (Fathoms)*	*Gear*		*Bottom Temp. °C.*	*Catch (Baske Cod*
			°	′	°	′					
51	7-8	1255	74	39½	17	06	90	R.F.		3·15	
		1330					90	Shot T. + C.1			
52		1500	74	33	17	03	90	Hauled T.			5
		1515					90	R.F.		3·30	
		1545					90	Shot T. + C.1			
53		1745	74	37	17	25	74	Hauled T.			5
		1755					73	R.F.		4·45	
		1820					74	Shot T. + C.1			
54		1950	74	33	17	26	78	Hauled T.			4
		2005					78	R.F.		3·87	
		2145–2245					78	A., 1m.St.			
55	8-8	0614	74	38	18	20	75	R.F.		4·15	
		0710					75	Shot T. + C.1			
56		0900	74	45	18	26	90	Hauled T.	(2)		
		0921					92	R.F.		3·74	
		1020					90	Shot T. + C.1			
57		1220	74	44	18	02	100	Hauled T.	(3)		1
		1230					110	R.F.		4·43	
58		1340	74	43½	18	17	100	Shot T. + C.1			
59		1540	74	45	18	45	82	Hauled T.			5
		1555					82	R.F.		3·74	
		1630					82	Shot T. + C.1			
60		1830	74	45	19	13	52	Hauled T.	(4)		2
		1845					53	R.F.		2·08	
		1920					52	Shot T. + C.1			
61		2120	74	44	19	38	36	Hauled T.			20
		2130					36	R.F.		2·35	
62	9-8	0650	74	51	20	04	31	R.F.		2·55	
		0740					36	Shot T. + C.1			
63		0940	74	53	20	25	30	Hauled T.			12
		0955					29	R.F.		1·60	
64		1105	75	00	20	42	29	R.F.		1·76	
		1120					28	Shot T. + C.1			
65		1300	74	57	21	05	44	Hauled T.			2
		1310					43	R.F.		0·14	
66		1440	74	47	20	50	42	R.F., B.T.		− 0·33	
		1512					42	1m.St.			
		1600					42	Shot T. + C.1			
67		1800	74	40½	20	36	44	Hauled T.			
		1810					44	R.F.		2·08	
68		1925	74	30½	20	36	64	R.F., B.T.		1·77	
		2000					66	Shot T. + C.1			
69		2100	74	26	20	40	94	Hauled T.			5
		2120					92	R.F.		1·80	
70	10-8	0654	74	28	20	39	78	R.F.		1·38	
		0715					74	Shot T. + C.1			
71		0915	74	33	20	23	56	Hauled T.			10
		0925					55	R.F.		0·49	
		1050					56	Shot T. + C.1			
72		1150	74	26	20	20	65	Hauled T.	(5)		2
		1155					65	R.F.		0·73	
73		1335	74	31	20	06	37	R.F.		− 0·18	
74		1445	74	41	19	59	30	R.F.		2·47	
75		1545	74	36	19	38	25	R.F.	(1)		
76		1707	74	28½	19	48	38	R.F.	(1)		
77		1852	74	20	19	34	34	R.F.		0·68	
78		1952	74	16	19	08	32	R.F.	(1)		
79		2150	74	01	19	08	67	R.F.		2·40	
		2200					70	Shot T. + C.1			
80		2330	74	01	18	40	75	Hauled T.			20

CRUISE VII. 1950—(*contd.*)

on	Date 1950	Time G.M.T.	Latitude N		Longitude E		Sounding (Fathoms)	Gear		Bottom Temp. °C.	Catch (Baskets) Cod
			°	′	°	′					
		2340	74	01	18	40	75	R.F.		2·50	
	11-8	0645	74	07	17	24	112	R.F.		3·24	
		0720					118	Shot T. + C.1			
		0850	74	12½	17	17	112	Hauled T.			2
		0900					111	R.F.		3·10	
		0955	74	18	17	04	114	R.F.		3·46	
		1030					112	Shot T. + C.1			
		1200	74	24½	17	11	98	Hauled T.			60
		1205					98	R.F.		3·40	
		1315	74	30½	17	24	85	R.F.		4·15	
		1350					86	Shot T. + C.1			
		1520	74	34	17	39	70	Hauled T.			40
		1530					70	R.F.		4·07	
		1600–1630					70	1m.St.			
		1725	74	38	17	56	58	R.F.		4·17	
		1750					60	Shot T. + C.1			
		1920	74	38	18	20	78	Hauled T.			3
		1930					76	R.F.		4·24	
		2045	74	35	18	35	42	R.F.		1·88	
		2140	74	33*	18	51	22	R.F.		2·18	
		2235	74	35*	19	15	34	R.F.		2·27	
	12-8	0007	74	45	19	26	51	R.F.		2·36	
		0053	74	52	19	26	39	R.F.		2·57	
		0149	74	59	19	26	22	R.F.		2·66	
		0244	74	59	18	56	31	R.F.		2·64	
		0345	74	52	18	56	52	R.F.		2·15	
		0452	74	48½	18	32	114	R.F.		3·24	
		0605	74	50	18	08	180	R.F.		2·85	
		0655	74	52	17	44	170	R.F.		2·56	
		0735	74	55½	17	47	76	R.F.	(1)		
		0810					80	Shot T. + C.1			
		0940	74	56½	17	30	106	Hauled T.			5
		0935					104	R.F.		3·42	
		1035					110	Shot T. + C.1			
		1210	75	03	17	25	98	Hauled T.			2
		1230					99	R.F.		3·43	
		1340	75	00	17	00	100	R.F.		4·28	
		1450	74	56	16	46	116	R.F.		4·34	
		1600	74	50	16	33	192	R.F.		4·01	
		1720	74	42	16	20	142	R.F.		3·76	
		1920	74	33	16	27	126	R.F.		4·91	
		1955					130	Shot T. + C.1			
		2130	74	27½	16	35	154	Hauled T.			10
		2150					154	R.F.		4·37	
		2230					154	Shot T. + C.1			
	13-8	0030	74	22	16	43	144	Hauled T.	(6)		10
		0045					149	R.F.		3·45	
		0120					140	Shot T. + C.1			
		0320	74	16	16	50	144	Hauled T.	(7)		4
		0330					148	R.F.		3·32	
		0355					140	Shot T. + C.1			
		0530	74	10	16	55	148	Hauled T.			2
		0545					145	R.F.		3·80	
		0615					145	1m.St.			

No temp. taken close to bottom.
Total catch 100 baskets, mixed cod and haddock.
0 baskets redfish.
baskets small haddock.

(5) After wing badly torn.
(6) 10 baskets redfish. 20 baskets coalfish.
(7) 5 baskets coalfish.

CRUISE VIII. 1950

Station No.	Date 1950	Time G.M.T.	Latitude N		Longitude E		Sounding (Fathoms)	Gear	Bottom °C. Temp.	Cat (Bask Co
			°	′	°	′				
1	1-10	1357–1425	70	46*	21	14	112	H.S.	6·77	
		1430					112	B.T.		
2		1647	71	06	21	04	106	B.T.		
		1658–1709					106	H.S.	6·48	
3		1925–1939	71	25	20	54	160	H.S.	5·10	
		1949					160	B.T.		
4		2254	71	55	20	35	190	B.T.		
		2312–2328					190	H.S.	4·75	
5	2-10	0243–0308	72	24	20	18	188	H.S.	3·53	
		0317					188	B.T.		
6		0635–0654	72	54	20	01	230	H.S.	2·40	
		0705					230	B.T.		
7		0950–1053	73	19	19	46	260	2-H., F., H.S., B.T.	1·76	
8		1152–1312	73	28	19	40	275	2-H., F., H.S., B.T.	1·59	
9		1428–1448	73	38	19	33	194	H.S.	2·00	
		1458					194	B.T.		
10		1538–1642	73	43	19	30	158	2-H., F., H.S., B.T. (1)		
11		1730–1813	73	53	19	24	88	2-H., H.S., B.T.	2·70	
12		1935–2010	74	08	19	14	57	2-H., H.S., B.T.	4·81	
13		2110–2135	74	16	19	09	32	2-H., H.S. (1)		
14	3-10	1808–1843	74	25*	18	32	25	2-H., F., H.S.	2·82	
15		1936–2013	74	25*	18	02	74	2-H., F., H.S., B.T.	3·62	
16		2118–2155	74	25*	17	24	91	2-H., F., H.S., B.T.	3·55	
17		2255–2335	74	25	16	46	118	2-H., F., H.S., B.T.	2·88	
18	4-10	0022–0036	74	25	16	27	154	H.S.	2·75	
		0045					154	B.T.		
19		0120–0300	74	25	16	08	467	2-H., F., H.S., B.T. (1)		
20		0400–0515	74	25	15	30	912	2-H., F., H.S., B.T. (1)		
21		0714–0831	74	25	14	15	1124	2-H., F., H.S., B.T. (1)		
22		1026	74	25	13	00	1230	B.T.		
		1039–1113					1230	H.S. (1)		
23		1936	74	15	17	40	96	R.F.	3·40	
24		2015	74	13	17	20	104	R.F.	3·40	
25		2115	74	10	17	01	116	R.F.	2·84	
26		2212	74	08	16	41	147	R.F.	2·72	
27		2310	74	05	16	20	196	R.F.	2·16	
28	5-10	0020	73	55	16	36	184	R.F.	2·72	
29		0215	73	46	16	51	214	R.F.	2·46	
30		0305	73	50	17	04	190	R.F.	2·62	
31		0345	73	53	17	18	150	R.F.	2·50	
32		0430	73	57	17	32	120	R.F.	2·70	
33		0512	74	02	17	46	112	R.F.	2·81	
34		0555	74	06	18	00	80	R.F.	3·22	
35		0640	74	10	18	15	69	R.F.	3·87	
36		0723	74	13	18	28	56	R.F.	3·64	
37		0805	74	17	18	41	27	R.F.	2·86	
38		0945	74	13	18	31	50	R.F.	3·42	
		1030					45	Shot T. + C.1		
39		1200	74	10	18	20	66	Hauled T. (2)		
		1210					66	R.F.	3·75	
		1245					65	Shot T. + C.1		
40		1415	74	04	18	21	70	Hauled T. (3)		
		1430					70	R.F.	3·64	
		1500					70	Shot T. + C.1		
41		1630	74	00	18	21	80	Hauled T. (4)		1
		1635					80	R.F.	2·72	
		1730					80	Shot T. + C.1		
42		1900	73	56	18	29	106	Hauled T.		1
		1915					106	R.F.	2·62	
		1945					106	Shot T. + C.1		

CRUISE VIII. 1950—(*contd.*)

Date 1950	Time G.M.T.	Latitude N		Longitude E		Sounding (Fathoms)	Gear		Bottom Temp. °C.	Catch (Baskets) Cod
		°	′	°	′					
5-10	2115	73	49	18	32	130	Hauled T.			15
	2135					130	R.F.		2·53	
	2200					132	Shot T. + C.1			
	2330	73	43	18	34	160	Hauled T.	(5)		1
	2350					160	R.F.		2·53	
6-10	0233	74	01	19	19	70	R.F.		2·50	
	0305	74	05	19	16	64	R.F.		3·64	
	0340	74	08	19	14	46	R.F.		5·15	
	0440	74	14	19	36	44	R.F.		3·70	
	0529	74	09	19	40	38	R.F.		3·42	
	0618	74	05	19	44	44	R.F.		2·62	
	0710	74	01	19	46	70	R.F.		2·08	
	0815					65	Shot T. + C.1			
	0945	74	06	19	30	40	Hauled T.			2
	1005					40	R.F.		3·43	
	1200	74	00	19	22	68	R.F.		2·50	
	1215					70	Shot T. + C.1			
	1350	73	59	19	06	73	Hauled T.			30
	1415					73	R.F., W/B.		2·55	
	1725	74	23	19	40	44	R.F., W/B.		2·42	
	1845	74	35	19	30	24	R.F., W/B.		2·85	
	2005	74	36	19	00	32	R.F.		2·83	
	2045	74	36	18	35	40	R.F.		3·00	
	2140	74	36	18	09	78	R.F.		3·76	
	2255	74	36	17	43	62	R.F.		3·84	
	2355	74	36	17	18	82	R.F.		3·85	
7-10	0055	74	36	16	51	98	R.F.		3·29	
	0150	74	36	16	26	150	R.F.		3·01	
	0252	74	43	16	26	114	R.F.		3·15	
	0655	74	44	16	38	145	R.F.		3·58	
	0715					120	Shot T. + C.1			
	0845	74	43	16	57	92	Hauled T.	(6)		
	0950					94	R.F.		3·62	
	1010					90	Shot T. + C.1			
	1140	74	43	17	22	76	Hauled T.	(7)		2
	1200					76	R.F.		4·14	
	1240					72	Shot T. + C.1			
	1410	74	42	17	46	64	Hauled T.	(8)		4
	1425					61	R.F.		4·03	
	1440					61	B.T.			
	1540					62	Shot T. + C.1			
	1710	74	42	18	04	86	Hauled T.	(9)		4
	1740					85	R.F.		3·83	
	1750					85	B.T.			
	1835					100	Shot T. + C.1			
	2005	74	42	18	26	60	Hauled T.			5
	2025					63	R.F.		3·64	
	2035					63	B.T.			
	2100					60	Shot T. + C.1			
	2230	74	44	18	44	70	Hauled T.			40
	2250					70	R.F.		3·80	
	2335					70	B.T.			
8-10	0510–0615					70	1m.St.	(10)		
	0730					85	Shot T. + C.1			
	0900	74	46	19	12	64	Hauled T.			60
	0920					64	R.F.		3·71	
	0930					64	B.T.			
	1000					64	Shot T. + C.1			
	1130	74	51	19	12	50	Hauled T.	(11)		20
	1200					49	R.F.		3·44	

CRUISE VIII. 1950—(*contd.*)

Station No.	*Date 1950*	*Time G.M.T.*	*Latitude N*		*Longitude E*		*Sounding (Fathoms)*	*Gear*		*Bottom Temp. °C.*	*C (Ba*
			°	′	°	′					
73	8-10	1210	74	51	19	12	49	B.T.			
		1245					50	Shot T.			
74		1415	74	51	18	43	80	Hauled T.	(12)		
		1435					78	R.F.		3·76	
		1500					70	Shot T.			
75		1630	74	46	18	44	80	Hauled T.	(13)		
		1640					80	R.F.		4·19	
		1715					90	Shot T.			
76		1845	74	43	18	45	57	Hauled T.			
		1910					57	R.F.		3·57	
		1955–2025					57	1m.St.			
	8/9-10	2043–0700					57	2-2m.Shp.	(14)		
77	9-10	0830	74	44	18	57	70	R.F.		3·64	
		0850					70	Shot T.			
78		1020	74	40	18	38	43	Hauled T.	(15)		
		1030					42	R.F.		3·17	
		1100					48	Shot T.			
79		1230	74	37	18	32	40	Hauled T.	(16)		
		1245					40	R.F.		3·57	
		1515					38	Shot T.			
80		1600	74	36	18	34	42	Hauled T.	(17)		
		1610					43	R.F.		3·66	
81		1815	74	31	18	05	60	R.F.		3·71	
		1845					60	Shot T.			
82		2015	74	32	17	52	64	Hauled T.	(18)		
		2035					61	R.F.		3·65	
		2120					64	Shot T.			
83		2245	74	31	17	38	74	Hauled T.	(19)		
		2320					74	R.F.		3·75	
84	10-10	0035	74	42	17	46	61	B.T.			
85		0123	74	42	17	22	70	B.T.			
86		0700	74	28	17	28	74	1m.St.			
		0730					81	R.F.		3·82	
		0800					84	Shot T.			
87		0930	74	26	17	12	98	Hauled T.			
		0945					98	R.F.		3·44	
		1015					98	Shot T.			
88		1145	74	21	17	04	110	Hauled T.	(20)		
		1205					110	R.F.		3·58	
89		1340	74	13	17	35	100	R.F.		3·49	
		1400					100	Shot T.			
90		1530	74	15	18	00	77	Hauled T.			
		1555					77	R.F.		3·59	
		1620					78	Shot T.			
91		1750	74	17	18	12	68	Hauled T.	(21)		
		1820					58	R.F.		4·11	
		1845					68	Shot T.			
92		1945	74	15	18	07	74	Hauled T.			
		2015					72	R.F.		3·79	
93		2220	74	16	19	09	32	H.S.	(1)		
94		2325–2338	74	08	19	14	46	H.S.	(1)		
		2343					46	B.T.	(22)		
95	11-10	0127–0142	73	53	19	24	103	H.S.		2·65	

(1) No temp. taken close to bottom.
(2) 10 baskets haddock, 5 baskets catfish.
(3) 15 baskets haddock.
(4) 10 baskets haddock.
(5) 40 baskets redfish, 10 baskets long rough dabs.
(6) Cod-end out.
(7) 10 baskets haddock.
(8) 15 baskets haddock.
(9) 10 baskets haddock.
(10) 1m.St. touched bottom.
(11) Belly torn, 5 baskets haddock.
(12) 10 baskets haddock.
(13) 30 baskets haddock.
(14) 1st haul of 2m.Shp. struck bottom.
(15) 10 baskets haddock.
(16) Belly badly torn.
(17) Net badly torn.
(18) 10 baskets haddock, 5 baskets catfish.
(19) 5 baskets haddock.
(20) Wings torn.
(21) 5 baskets haddock, 5 baskets catfish.
(22) B.T. lost.

CRUISE IX. 1950

Date 1950	Time G.M.T.	Latitude N		Longitude E		Sounding (Fathoms)	Gear		Bottom Temp. °C.	Catch (Baskets) Cod
		°	′	°	′					
13-11	2354	73	30	18	19	220	R.F.		2·68	
14-11	0020					220	R.F.			
	0128	73	41	18	27	170	R.F.	(1)		
	0228	73	46	18	31	142	R.F.		2·56	
	0325	73	51*	18	35	120	R.F.		2·82	
	0335					120	R.F.			
	0422	73	55*	18	38	97	R.F.		2·95	
	0508	74	01*	18	40	60	R.F.		2·90	
	0554	74	06*	18	43	40	R.F.		1·78	
	0640	74	11*	18	51	36	R.F.	(1)		
	0650					36	R.F.			
	0904	74	06*	19	05	50	R.F.		1·68	
	0920					50	Shot T.			
	1050	74	02*	19	03	54	Hauled T.			15
	1100					55	R.F.	(1)		
	1130					52	Shot T.			
	1300	73	58*	19	13	70	Hauled T.			45
	1320					70	R.F.		2·90	
	1350					68	Shot T.			
	1425	73	58*	19	20	74	Hauled T.	(2)		
16-11	0619	73	49*	19	52	160	R.F.		2·50	
	0717	73	54*	19	44	112	R.F.		2·52	
	0808	73	58½*	19	40	78	R.F.		2·86	
	0902	74	03*	19	32	66	R.F.		2·52	
	0946	74	09*	19	27	62	R.F.		1·64	
	1027	74	11	19	26	50	R.F.		1·32	
	1050					55	Shot T.			
	1150	74	09½	19	34	60	Hauled T.			19
	1210					60	R.F.		1·41	
	1255					55	Shot T.			
	1355	74	07	19	40	57	Hauled T.			14
	1408					57	R.F.		2·50	
	1440					55	Shot T.			
	1610	74	01½	19	30	70	Hauled T.			9
	1622					70	R.F.		2·74	
	1655					70	Shot T.			
	1825	73	57	19	38	80	Hauled T.			20
	1840					80	R.F.		2·90	
	1920					80	Shot T.			
	2050	73	52	19	36	110	Hauled T.			5
	2108					110	R.F.		2·86	
17-11	0032	73	41	20	14	250	R.F.		1·63	
	0945	74	38	18	55	37	R.F.		1·36	
	1030	74	43	18	55	52	R.F.		1·71	
	1130	74	51	18	55	70	R.F.		3·16	
	1228	74	51	18	24	130	R.F.		4·02	
	1320	74	48	18	24	137	R.F.		4·08	
	1420	74	44	18	22	80	R.F.		4·07	
	1506	74	40	18	22	78	R.F.		2·21	
	1605	74	40	17	58	71	R.F.		4·05	
	1659	74	35	17	55	65	R.F.		4·54	
	1748	74	31	17	55	70	R.F.		2·92	
	1837	74	31	17	38	66	R.F.		3·62	
	1935	74	36	17	38	64	R.F.		3·55	
	2037–2055	74	40½	17	36	62	3-R.F.	(3)		
18-11	0018	74	48	18	44	90	R.F.		3·69	
	0203	74	35	18	22	52	R.F.		2·18	
	0625	74	31½	17	45	64	R.F.		4·42	
	0700					65	Shot T.			
	0800	74	34½	17	45	62	Hauled T.			3

CRUISE IX. 1950—(*contd.*)

Station No.	*Date 1950*	*Time G.M.T.*	*Latitude N*		*Longitude E*		*Sounding (Fathoms)*	*Gear*		*Bottom Temp. °C.*
			°	′	°	′				
41	18-11	0815	74	34½	17	45	62	R.F.		4·80
		0850					62	Shot T.		
42		1005	74	30½	17	30	76	Hauled T.	(4)	
		1020					76	R.F.		3·53
		1110					78	Shot T. + C.1		
43		1210	74	34	17	28	76	Hauled T.	(5)	
		1222					76	R.F.		4·50
		1245					78	Shot T. + C.1		
44		1345	74	29	17	21	89	Hauled T.	(6)	
		1408					89	R.F.		3·97
		1430					90	Shot T. + C.1		
45		1530	74	26	17	22	97	Hauled T.	(7)	
		1550					96	R.F.		3·98
		1620					95	Shot T. + C.1		
46		1720	74	26	17	35	80	Hauled T.	(8)	
		1735					80	R.F.		3·36
		1810					80	Shot T. + C.1		
47		1910	74	29	17	34	78	Hauled T.		
		1925					78	R.F.		3·04
48		2111	74	36	17	20	84	R.F.		4·86
49		2158	74	38½	17	38	70	R.F.		4·79
50		2230	74	40½	17	34	68	R.F.		4·70
51		2320	74	45½	17	34	134	R.F.		4·68
52	19-11	0145	74	44½	18	42	92	R.F.		4·31
53		0238	74	40	18	38	42	R.F.		3·28
54		0337	74	36½	18	16	72	R.F.		3·68
55		0435	74	31½	18	16	54	R.F.		2·84
56		0753	74	37	18	17	66	R.F.		3·36
		0820					65	Shot T. + C.1		
57		0920	74	40	18	29	52	Hauled T.	(9)	
		0938					52	R.F.		1·70
		1045					55	Shot T. + C.1		
58		1110	74	39	18	31	48	Hauled T.	(10)	
59a		1235	74	42½	18	39	55	Shot T. + C.1		
59		1335	74	43½	18	49	72	Hauled T.		
		1400					72	R.F.		3·33
		1430					78	Shot T. + C.1		
60		1530	74	48½	18	51	90	Hauled T.		
		1548					90	R.F.		4·20
		1615					85	Shot T. + C.1		
61		1715	74	46	18	41	110	Hauled T.		
		1800					110	R.F.		4·71
		1820					110	Shot T. + C.1		
62		1920	74	45	18	27	78	Hauled T.	(11)	
		1940					78	R.F.		3·92
		2034					78	R.F.		
		2040					102	B.T.	(12)	
63		2120	74	46½	18	34	114	B.T.		
64	20-11	0108	74	35	17	00	90	R.F.		4·45
65		0200	74	35	16	41	102	R.F.		4·28
66		0252	74	35	16	22	142	R.F.		3·54
67		0350	74	30	16	28	130	R.F.		3·76
68		0438	74	30	16	50	106	R.F.		4·09
69		0532	74	30	17	15	92	R.F.		4·04
70		0635	74	25	17	15	96	R.F.		4·07
71		0725	74	25	16	55	106	R.F.		3·84
72		0819	74	25	16	35	135	R.F.		3·56
73		0900	74	25	16	23	160	R.F.		4·05
74		0945	74	20	16	26	194	R.F.		3·89
75		1027	74	20½	16	42	136	R.F.		3·47

ion	Date 1950	Time G.M.T.	Latitude N		Longitude E		Sounding (Fathoms)	Gear	Bottom Temp. °C.	Catch (Baskets) Cod
			°	′	°	′				
5	20-11	1112	74	21½	17	02	110	R.F.	3·66	
7		1155	74	22½	17	18	98	R.F.	4·02	
8		1242	74	23	17	36	80	R.F.	3·80	
9		1327	74	18	17	24	95	R.F.	3·87	
0a		1435	74	24½	16	52	110	R.F. **(13)**		
		1515					115	Shot T. + C.1		
0		1645	74	27	16	42	115	Hauled T.		25
		1705					116	R.F.	4·35	
		1730					125	Shot T. + C.1		
1		1900	74	29	16	38	115	Hauled T. **(14)**		
		1925					112	R.F.	4·53	
		2010					110	Shot T. + C.1		
2		2140	74	26	16	36	118	Hauled T.		30
		2155					116	R.F.	4·14	
		2230					114	Shot T. + C.1		
3		2400	74	22	16	45	130	Hauled T.		30
	21-11	0019					130	R.F.	3·72	
4		0300	74	34½	17	12	88	R.F., B.T. **(15)**		
5		0335	74	34½	17	16	86	R.F., B.T.		
6		0435	74	34½	17	05	96	R.F., B.T.		
7		0930	74	25	14	55	1084	R.F., B.T.		
		0955–1005					1084	2-H.		
8		1115–1128	74	25	15	30	900	2-H.		
		1135					900	R.F., B.T.		
9		1236–1248	74	25	16	08	678	2-H.		
		1300					678	R.F., B.T.		
0		1407–1422	74	26	16	42	130	2-H.		
		1425					130	R.F., B.T.		
		1427–1511					130	1m.St.		
1		1623–1632	74	26	17	16	96	2-H.		
		1635					96	R.F., B.T.		
		1657–1717					96	A.		
2		1845–1950	74	25	18	02	68	2-H., R.F., B.T., A.		
3		2045–2050	74	25	18	32	26	2-H.		
		2100					26	R.F., B.T.		
		2105–2125					26	A. **(16)**		
4		2258–2303	74	16	19	09	30	2-H.		
		2310					30	R.F., B.T.		
5	22-11	0001–0118	74	08	19	14	43	2-H., R.F., B.T., 1m.St.		
6		0305–0403	73	53	19	24	103	4-H., R.F., B.T. **(17)**		
7		0504–0532	73	43	19	30	174	2-H., R.F., B.T.		
8		0650–0712	73	28	19	40	260	2-H., R.F., B.T.		
9		0811–0833	73	19	19	46	256	2-H., R.F., B.T.		
0		1120	72	54	20	01	230	R.F., B.T.		
1		1450	72	24	20	18	204	R.F., B.T.		
2		1800	71	55	20	26	178	R.F., B.T.		
3		2110	71	28	20	32	142	R.F., B.T.		
4		2350	71	09	20	36	100	R.F., B.T. **(15)**		
5	23-11	0245	70	46	21	14	114	R.F., B.T. **(18)**		
6	27-11	0930	73	42	19	29	180	R.F.	2·60	
		1020					175	Shot T. + C.1		
7		1150	73	48	19	26	148	Hauled T. **(19)**		
		1212					148	R.F.	2·64	
		1250					146	Shot T. + C.1		
8		1420	73	52	19	17	108	Hauled T. **(20)**		
		1440					108	R.F.	2·84	
		1530					108	Shot T. + C.1		
9		1700	73	56	19	28	79	Hauled T.		5
		1717					79	R.F.	3·12	
		1750					79	Shot T. + C.1		

CRUISE IX. 1950—(*contd.*)

Station No.	*Date 1950*	*Time G.M.T.*	*Latitude N*		*Longitude E*		*Sounding (Fathoms)*	*Gear*		*Bottom Temp. °C.*	*Cat (Bask Co*
			°	′	°	′					
110	27-11	1920	74	01½	19	22	64	Hauled T.			12
		1940					63	R.F.		2·72	
111		2130	74	06	19	17	49	R.F.		0·82	
112		2240	74	06	19	36	48	R.F.		1·31	
113		2335	74	01½	19	45	60	R.F.		1·86	
114	28-11	0030	73	57	19	54	92	R.F.		3·45	
115		0305	74	00	19	00	60	R.F.		2·98	
116		0435	74	00	18	17	80	R.F.		3·12	
117		0612	74	00	17	34	116	R.F.		3·20	
118		0717	74	03½	17	52	98	R.F.		3·19	
119		0810	74	05	18	09	68	R.F.		3·13	
120		0908	74	03½	18	35	66	R.F.		3·05	
		0940					66	Shot T. + C.1			
121		1110	74	02	18	39	59	Hauled T.	(21)		
		1120					59	R.F.		3·18	
122a		1350	74	01½	18	33	60	Shot T. + C.1			
122		1520	73	59½	18	54	64	Hauled T.			40
		1535					66	R.F.		3·24	
		1600					64	Shot T. + C.1			
123		1730	73	57	19	10	82	Hauled T.	(22)		17
		1740					82	R.F.		3·14	
		1830					80	Shot T.			
124		2000	73	58	19	16	70	Hauled T.			5
		2015					71	R.F.		2·84	
		2045					75	Shot T.			
125		2215	73	56½	19	28	82	Hauled T.			8
		2230					82	R.F.		3·07	
126	29-11	0110	74	07	18	52	38	R.F.	(1)		
127		0155	74	08	18	34	52	R.F.	(1)		
128		0240	74	09	18	18	63	R.F.	(1)		
129		0800	73	52	19	00	110	R.F.		2·80	
		0830					115	Shot T.			
130		1000	73	53	18	34	108	Hauled T.			2
		1025					107	R.F.		2·78	
		1100					114	Shot T.			
131		1230	73	55	18	08	110	Hauled T.			8
		1250					110	R.F.		3·15	
		1335					110	Shot T.			
132		1505	73	58	17	48	114	Hauled T.			4
		1520					114	R.F.		3·46	
		1618–1704					114	1m.St.			
133		1926	74	09	18	22	70	R.F.			
		2030					70	R.F., B.T.	(1)		
134		2350	73	59	17	13	135	R.F.		2·76	
135	30-11	0043	73	59	16	46	154	R.F.		2·66	
		0055–0143					154	1m.St.			
136		0233	73	59	16	28	178	R.F.		2·66	
137		0315	74	04	16	28	184	R.F.		2·76	
138		0412	74	04	16	46	134	R.F.		3·22	
139		0508	74	09	16	46	148	R.F.		2·75	
140		0550	74	09	16	28	180	R.F.		2·82	
141		0700	74	15	16	28	174	R.F.		3·03	
142		0800	74	15	16	46	129	R.F.		2·77	
143		0900	74	15	17	05	110	R.F.		3·94	
144		0945	74	21	17	05	98	R.F.		4·24	
145		1022	74	21	16	46	114	R.F.		3·74	
146		1130	74	21	16	28	166	R.F.		3·74	
147		1220	74	27	16	28	150	R.F.	(1)		
148	1-12	0050	74	24	17	05	106	R.F.		4·08	
149		0145	74	24	16	46	130	R.F.		3·60	

CRUISE IX. 1950—(*contd.*)

ion).	Date 1950	Time G.M.T.	Latitude N		Longitude E		Sounding (Fathoms)	Gear		Bottom Temp. °C.	Catch (Baskets) Cod
			°	′	°	′					
)	1-12	0230	74	24	16	28	183	R.F.		3·48	
1		0330	74	29	16	28	152	R.F.		4·44	
2		0440	74	34	16	28	140	R.F.		4·76	
3		0530	74	39	16	28	140	R.F.		4·36	
4		0615	74	39	16	46	102	R.F.		4·34	
5		0700	74	34	16	46	102	R.F.		4·10	
6		0743	74	29	16	46	103	R.F.		4·35	
7		0850	74	29	17	05	98	R.F.		3·82	
8		0955	74	28	16	42	122	R.F.		3·80	
		1020					120	Shot T.			
9		1150	74	23	16	50	128	Hauled T.	**(23)**		
		1215					128	R.F.	**(24)**		
		1245					130	Shot T.			
0		1415	74	17	17	04	125	Hauled T.	**(25)**		30
		1435					126	R.F.		3·66	
		1520					120	Shot T.			
1		1650	74	13½	17	14	124	Hauled T.	**(26)**		
		1705					124	R.F.		3·74	
		1800					118	Shot T.			
2		1930	74	09	17	06	128	Hauled T.			3
		1950					137	R.F.		3·27	
3	2-12	0620	74	08	16	32	148	R.F.		2·72	
		0640					150	Shot T.			
4		0810	74	11	16	34	157	Hauled T.			12
		0835					155	R.F.		2·57	
		0900					160	Shot T.			
5		1030	74	13	16	34	148	Hauled T.	**(27)**		18
		1055					147	R.F.		3·67	
		1225					160	Shot T.			
6		1400	74	16	16	34	148	Hauled T.	**(28)**		8
		1420					145	R.F.		4·16	
7	3-12	1857	74	22½	17	04	96	R.F.		4·40	
		1940					98	Shot T.			
8		2110	74	20	16	58	112	Hauled T.	**(29)**		25
		2130					112	R.F.		4·02	
9	4-12	0640	74	20	16	58	112	R.F.		4·40	
		0700					110	Shot T.			
0		0830	74	17	17	10	102	Hauled T.	**(30)**		30
		0850					102	R.F.		4·24	

) No temp. taken close to bottom.
) Warp parted from door.
) Three faulty attempts.
) 12 baskets haddock.
) 5 baskets haddock.
) 10 baskets haddock.
) 10 baskets haddock.
) 7 baskets haddock.
) Both bunts out.
) Came fast, fore wing out.
) 5 baskets haddock.
) B.T. failed to record.
) Frame lost.
) Cod-end torn.
) Stations 84–104, surface temps. only.
) Aggasiz net burst on hauling.

(17) 4-H, all hauls foul.
(18) Thermometer failed to function.
(19) Small hole in cod-end.
(20) Large hole in cod-end.
(21) After wing, belly and cod-end torn.
(22) Cod-end cover badly torn and removed.
(23) Small hole in cod-end.
(24) Thermometer failed to function.
(25) 55 baskets redfish.
(26) Fore door, G-link parted.
(27) After wing torn.
(28) 22 baskets redfish. Both wings out.
(29) Bosom torn.
(30) Parted bridle. Fore wing out. 10 baskets haddock.

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